2021

POLITICAL SCIENCE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or **Bengali** or in **Nepali** but all answers must be in one and same language.*

Group-A

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

1. Discuss Machiavelli's concept of State Power. 40
2. Examine Rabindranath's concept of Nationalism. 30
3. Discuss John Rawls' concept of justice with the main lines of criticism levelled against it. 30
4. Discuss Ambedkar's concept of caste in Indian society and politics. 30

Group-B

Answer Question *No.5* and *any two* from the rest.

5. Discuss the concept of Parliamentary sovereignty in India. Is it comparable to the British system? 40
6. Examine the role of Rajya Sabha in the context of Indian Federalism. 30
7. Discuss the role of the Governor in the Indian Constitution. Does he enjoy any discretionary power? 30
8. Does communalism play any role in Indian politics? 30

2021

POLITICAL SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or* ***Bengali*** *or in* ***Nepali*** *but all answers must be in one and same language.*

Group-A

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

1. Analyse Weber's theory of bureaucracy. 40
2. Discuss the various principles of administrative organization. 30
3. Analyse the basic features of development administration. 30
4. Analyse the changing role of District Collectors. 30

Group-B

Answer Question *No.5* and *any two* from the rest.

5. Discuss how far the concept of bipolarity is relevant to International Relation today. 40
6. Discuss the concept of globalization in the context regional politics. 30
7. Discuss India's relation with the USA in recent times. 30
8. Discuss India's Kashmir question. 30

2021

SOCIOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. Examine tradition and modernity. Is tradition standing in the way of modernity of India? Give reasons in support of your answer. 40

2. Give a detailed analysis of the structural-functional approach of Srinivas for the study of Indian society. What are the defects in this method of analysis? 25+15=40

3. Discuss the impact of some of the existing programmes initiated by the Government of India for the development of women. 40

4. Write a note on the problems of child labour in some of the industries of India. 40

5. What function does education have in Indian society? Show whether education has been able to eradicate inequality in society. 20+20=40

Group-B

Answer *any two* questions.

6. What is meant by Social Reforms? Narrate, in brief, any social reform that has taken place in Indian society. 15+25=40

7. Who are the Other Backward Classes? State some of the Constitutional safeguards taken by the Government of India for the uplift of the Backward Classes. 10+30=40

8. Give an outline of the ecological and environmental movements in India. 40

2021

SOCIOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Give a brief idea of the scope of Sociology.

   (b) Examine the relation between common sense and sociology. 20+20=40

2. Briefly evaluate Max Weber's thesis in *The Protestant Ethic and the Spirit of Capitalism.* 40

3. Discuss the changing nature of definitions and functions of the family in modern societies. 40

4. Analyse the role of education in social change focussing especially on its relation with promotion or obstruction of equality in society. 40

5. Write short notes on:

   (a) Karl Marx's notion of alienation

   (b) Georg Simmel's idea of subjective culture and objective culture 20+20=40

Group-B

Answer *any two* questions.

6. Examine the utility and limitation of field study in grasping the social reality in modern times, highlighting the chief techniques of field study. 40

7. Briefly outline the major models of development. How far does the capitalist mode of development eliminate or enhance dependency of the underdeveloped or developing nations? 20+20=40

8. Scientific temper is both a progenitor and a child of scientific and technological development. Discuss. 40

2021

PSYCHOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. What is perception? What are the different types of perception? Discuss the Gestatt view of perception. 5+15+20=40

2. What is trial and error learning? Explain the factors behind trial and error learning. State the laws of learning as proposed by Thorndike. How is trial and error learning different from insightful learning? 5+10+20+5=40

3. What is memory? Classify memory into different types and explain in details with examples. Suggest some strategies to enhance memory. 5+25+10=40

4. Discuss in detail about the two factors of emotion. Describe the experiment that validated this theory. How is it different from earlier theories of emotion? 15+15+10=40

5. Discuss the theory of multiple intelligence citing suitable examples. How is it different from earlier theories of intelligence? State the application of the theory of multiple intelligence. 20+10+10=40

6. (a) What is problem solving? What are the methods used to solve problems? Discuss the barriers to problem solving. 5+15+10=30

   (b) Is problem solving always straight forward? Discuss the process by which we come up with new ideas and solutions. 4+6=10

7. Critically discuss Piaget's theory of cognitive development. Why is this theory still relevant today? State its applications. 25+5+10=40

Group-B

Answer *any two* questions.

8. Discuss the three forms of social bias viz. prejudice, stereotypes and discrimination. Delineate the basic processes underlying such biases. State the different ways of reducing prejudice. 15+15+10=40

9. What is interest? How is it measured? Why is interest important in the field of psychology? 15+15+10=40

10. Discuss different aspects of social and emotional development in adolescence. How do these changes influence their transition to adulthood? 25+15=40

2021

PSYCHOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

The figures in the margin indicate marks for each question.

Group-A

Answer *any three* questions.

1. Discuss Sigmund Freud's Topographical theory of mind and Structural theory of mind. How are they related? 30+10=40

2. Delineate, with the help of a hypothetical case example, the clinical features of Major Depression. What are the etiological factors of Major Depression? 20+20=40

3. What is a standardized test? Describe with examples, the steps for constructing a standardized psychological test. 5+35=40

4. (a) When does stress occur? What are the different types of stress? Discuss the major consequences of stress.

   (b) Describe some major stress management techniques to be used for reduction of chronic stress. (5+5+10)+20=40

5. Discuss the major principles and stages of Client Centred Therapy. Describe a hypothetical case of Anxiety disorder and demonstrate the applicability of Client Centred Therapy for this case. 15+15+10=40

6. (a) What is a Normal Probability Curve? Describe the characteristics of a Normal Probability curve.

   (b) Define sampling. Describe with suitable examples different sampling techniques for psychological research. (5+10)+(5+20)=40

Group-B

Answer *any two* questions.

7. (a) Critically discuss Herzberg's theory of motivation, delineating its implication in organizations.

   (b) How can you motivate and train people for entrepreneurship? 20+20=40

8. Describe the psychosocial problems related to old age, with special reference to Indian geriatric population. Provide suggestions for management of such problems at personal, familial and community levels. 25+15=40

9. (a) "Casteism in India is presently one of the biggest threats to social integration"— Do you agree? Justify your answer.

   (b) Suggest psychologically informed intervention at policy level and in social-personal spheres for reducing the negative consequences of caste based discrimination. 20+20=40

10. Write notes on *any two*: 20×2=40

    (a) Rehabilitation Psychology

    (b) Nature-nurture debate in psychology

    (c) Leadership styles and characteristics of a good leader

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2021

GEOGRAPHY

PAPER-I

Full Marks — 200

Time Allowed — 3 Hours

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Illustrate your answers with suitable sketches and diagrams.

Answer any five *questions, taking at least* two *from each group.*

Group-A

1. Examine critically the concept of Isostasy as put forward by Sir G.B. Airy and A. Pratt. Classify earth movements and mention the resultant landforms in brief. 25+15

2. Account for the increase of greenhouse gases and discuss its impact. Make a comparison between the origin and characteristics of tropical and mid-latitude cyclones. 25+15

3. Classify natural hazard and explain in detail it's reduction and management. Correlate population and environmental quality. 30+10

4. Discuss the fundamental concept of GIS (Geographical Information System) with particular reference to the use of RS (Remote Sensing) data in GIS. Distinguish between a Satellite with a Geo-stationary orbit and a Satellite with a Sun-synchronous orbit. 30+10

5. Classify ocean deposits on the basis of origin, elements and location. What are the factors influencing the distribution of temperature and salinity of ocean water? 25+15

Group-B

6. Analyze critically the economic growth model propounded by Gunner Myrdal. What are the drawbacks of Webrian Model of industrial location in the contemporary world of globalization? 30+10

7. Discuss how Malthusian theory of population growth differs from the Marxist concept of population growth and its control. How does the age structure affect the growth of population? 30+10

8. Evaluate the concept of space in Geography. Discuss with examples how social processes affect social behaviour. 20+20

9. Explain the evolution and hierarchy of urban settlement. Classify urban settlements based on its functions. 20+20

10. How agricultural development can be related with the regional development? Explain the issue with the help of rural development programmes in India. Distinguish between formal and functional regions. 30+10

2021

GEOGRAPHY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer Question 1 *and* any two *from the rest.*

1. Divide India into physiographic regions and justify the bases of your regionalization. Describe in detail the structure of the Western Himalayas with particular reference to its impact on relief. Support your answer with suitable sketches. What is the significance of the Main Boundary Fault? 10+(20+5)+5=40

2. What is meant by Ramsar site? Assess the ecological importance of major wetlands in India. On what consideration the Damodar Valley Corporation was selected by the Govt. of India as the first major multipurpose project? Analyze the performance of DVC in flood control. 3+7+8+12=30

3. Discuss the influence of climate on the distribution of natural vegetation in India. Make a critical analysis of the success and failures of Social Forestry as a tool for sustainable forest management in India. 20+10=30

4. Account for the location of cotton textile industry in India. What are the future prospects of this industry in the country? Discuss the economic significance of Chotanagpur Plateau. 15+5+10=30

5. Give a reasoned geographical account of the varying density of population in India (2011). Analyze the salient features of the National Population Policy, 2011. 20+10=30

Group-B

Answer Question 6 *and* any two *from the rest.*

6. Attempt an agro-climatic regionalization of West Bengal and discuss the salient features of each region. Analyze the causes of spatial variation of agricultural productivity in the state. Mention the role of contract farming in the region. 20+15+5=40

7. Divide deltaic West Bengal into suitable geomorphic units and discuss their essential features. Evaluate the role of Farakka Barrage in ameliorating the problem of siltation in Kolkata Port. 20+10=30

8. Critically analyze how reclamation affected the physical characteristics of the Sundarbans. What is the significance of the Man and Biosphere programme in conservation and management of biodiversity in the Sundarbans? 20+10=30

9. Elucidate the major problems of industrialization in West Bengal in the last two decades. In what way the development of SEZ and the thrust on small and medium enterprises (SME's) can influence the emerging industrial scenario of the state? 10+20=30

10. Account for the structure and composition of population in West Bengal. Highlight on the Government Schemes implemented to solve the problem of gender bias in literacy. 20+10=30

2021

HISTORY

PAPER-I

Time Allowed—3 Hours *Full Marks—200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

1. Answer *any three* questions: 10×3=30

   (a) Discuss the importance of Inscriptions in unearthing the history of Ancient India.

   (b) How do you explain the rise of Magadha empire in the 6th century B.C.?

   (c) How far Asoka was responsible for the decline of the Mouryan empire?

   (d) What were the fundamental principles of Buddhism?

2. Answer *any two* questions: 20×2=40

   (a) Write an essay on the urban life of the Indus Valley Civilization.

   (b) Give an overview on the cultural contributions of the Kushana dynasty.

   (c) Write a short note on provincial administration in Gupta period.

   (d) What do you know about the development of Sangam literature?

3. Write an essay on *any one*: 30×1=30

   (a) Expansion of Indian culture in South-Asian countries in ancient times.

   (b) Role of guilds in Ancient Indian trade.

   (c) Position of women in Ancient Indian society.

Group-B

4. Answer *any three* questions: 10×3=30

   (a) Do you think Illtutmish was the real founder of Delhi Sultanate?

   (b) Discuss the importance of *Khalji* revolution.

   (c) What do you know about Shivaji's finance and revenue?

   (d) How did the foreign travellers describe the Vijaynagar empire?

5. Answer *any two* questions: 20×2=40

   (a) Explain the role of trade in the economy of the sultanate period.

   (b) Discuss the Rajput policy of Akbar and its impact.

   (c) Do you agree with the view that 'agrarian crisis' was the main factor behind the downfall of the Mughal empire?

   (d) Analyse the salient features of the *Bhakti* movement.

6. Write an essay on *any one*: 30×1=30

   (a) The evolution of Iqta system during the Sultanate period.

   (b) Development of science and technology under the Mughals.

   (c) Social conditions of India in Eighteenth century.

2021

HISTORY

PAPER-II

Time Allowed—3 Hours *Full Marks—200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

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

1. Answer *any one* question:
   (a) Analyse the historical backdrop to the battle of Plassey. What was its impact? 15+5=20
   (b) Was the notion of de-industrialization during British rule a myth? 20
   (c) What was the role of political associations in fostering political consciousness in India before the birth of Indian National Congress? 20

2. Analyse the origins and impact of the Permanent Settlement in Bengal. 20+20=40

3. Assess Iswar Chandra Vidyasagar's contributions to Bengali society. 40

4. What led to the Partition of India? 40

Group-B

Answer Question No. 5 *and* any two *from the rest.*

5. Answer *any one* question :
   (a) Write a critical note on the American War of Independence (1776). 20
   (b) Comment on the nature of industrialization in Russia. 20
   (c) Assess the role of the UNO in the Korean War and Cuban Missile Crisis. 20

6. What led to the scramble for colonies in the second half of the nineteenth century? 40

7. How would you explain the origins of the Cold War? 40

8. Analyse the origins and growth of Apartheid in South Africa. How did it come to end? 30+10=40

2021

ANTHROPOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answer must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) What are the differences between out of Africa and multiregional theories of human origin? Discuss briefly with evidences multiregional continuity model of modern human origin.

   (b) Write an easy on synthetic theory of evolution. (5+15)+10=30

2. (a) What is inbreeding? What are the differences between consanguinity and inbreeding? Calculate coefficient of inbreeding of first cousin marriage.

   (b) Discuss briefly Hardy-Weinberg equilibrium with suitable example. (4+6+10)+10=30

3. (a) Define somatotype. Discuss in brief Heath-Carter method of somatotyping.

   (b) What is BMI? Write down recent classification of nutritional states by WHO on the basis of BMI. Critically evaluate use of WHO classification in Indian context. (5+10)+(4+3+8)=30

4. (a) Define growth. What are the differences between growth and development? Write a brief note on different methods of growth study.

   (b) Write a short note on factors affecting human growth. (2+4+9)+15=30

Group-B

Answer *any three* questions.

5. (a) What are the differences between excavation, exploration and site survey?

   (b) Write a brief note on method of C^4 dating and its application in anthropology. Write its merits and demerits. 15+(10+5)=30

6. (a) What is post-structuralism? What are the differences between post-structuralism and post-modernism theories in social science?

   (b) What are the major characteristic features of culture? (6+14)+10=30

7. (a) Define marriage. What do you mean by preferential and prescribed forms of marriage? Discuss its different forms.

   (b) Define Kinship. What are the different types and major patterns of kinship system found worldwide (by Morgan)? (5+5+5)+(3+12)=30

8. (a) Define Anthropology of religion. What are the basic functions of religion as relevant in present society?

   (b) Write a short note on cultural ecology. (6+12)+12=30

Group-C

9. Write short notes on *any two* of the following: 10×2=20

   (a) Double burden of malnutrition

   (b) Anthropology of gender

   (c) Participant observation

   (d) Testing of hypothesis

2021

ANTHROPOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group – A

Answer *any three* questions.

1. Briefly define the terms SC, ST & OBC as laid in Indian Constitution. What are the Constitutional safeguards for the STs and Constitutional provisions of 5th and 6th schedule? 10+10+10+10=40
2. Discuss critically the ideas of Universalization-Parochialization, and Tribe - Peasant Continuum in understanding Indian Civilization. Discuss the present major problems of the tribals of India in reference to land and forest. 10+10+10+10=40
3. Define Ethnicity. Discuss the issues of ethnicity and tribal movements with special reference to the tribes of Central India. 10+30=40
4. What is meant by Demography? Briefly illustrate its different demographic theories. Enumerate the rural demographic dynamics in relation to sex ratio and migration with suitable examples. 10+10+20=40
5. Write short notes on *any two*: 20×2=40
   (a) Indian Chopper - Chopping complex
   (b) Sex-Ratio
   (c) Human Rights and Anthropology
   (d) Association of fecundity, fertility and modernization

Group – B

Answer *any two* questions.

6. Critically evaluate the ethnic classification of India by B.S. Guha and S.S. Sarkar. 20+20=40
7. Critically evaluate the different approaches of Sustainable development. Discuss the role of Anthropology in development. 20+20=40
8. Define Ethnoarchaeology. Discuss ethnoarchaeological aspects in reference to Megalithic burials found in India and the mortuary practices of Indian tribes. 10+20+10=40
9. Critically evaluate the contributions of N.K. Bose and S.C. Sinha in development of Indian Anthropology. 20+20=40

2021

LAW

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Article 14 uses two expressions—
   (i) Equality before law and
   (ii) Equal protection of law.
   Explain these two expressions.
   (b) 'Article 14 permits Reasonable Classifications but prohibits Class Legislation'—Define. 20+20=40

2. (a) What do you mean by Directive Principles of State Policy? What are the nature and scope of Directive Principles?
   (b) How will you differenciate the Directive Principles from Fundamental Rights? 20+20=40

3. (a) Explain the Jurisdiction of the High Court under Article 226. Enumerate the Writs.
   (b) What is the distinction between Article 32 and 226? What is Judicial Review? 20+20=40

4. (a) Who can proclaim Emergency? What are the grounds for proclamation of Emergency?
   (b) What are the consequences on the Proclamation of Emergency under Article 352? What are the effects of Financial Emergency? 20+20=40

5. (a) What is the procedure for Amendment of the Constitution?
   (b) What is the Doctrine of Prospective Overruling? 20+20=40

6. Write short notes on *any two* of the following: 20+20=40
   (a) Validation of Void Laws-Doctrine of Eclipse
   (b) Protection in respect of conviction for offences under Article 20

(c) Different facets of the Right to Life.

(d) Repugnancy between a Union Law and a State Law.

Group-B

Answer *any one* question.

7. (a) What is Extradition? What is the purpose of Extradition?

   (b) Is Extradition a Legal Duty of a State? What are Extradition Treaties? 20+20=40

8. (a) Explain the theories of Recognition.

   (b) What are the forms and modes of Recognition? 20+20=40

Group-C

Answer *any one* question.

9. (a) "The expression 'Jurisprudence' which at first denoted a knowledge of law came through the development of the conception to express the idea of a Science of Law". Explain this statement with reference to the origin of the word 'Jurisprudence'.

   (b) Discuss the practical role played by Jurisprudence in modern Society. 20+20=40

10. (a) Write an essay on Dean Roscoe Pound's concept of Social Engineering.

    (b) Compare Legislation with Precedent. Explain which one as a source of law, superior to the other. 20+20=40

2021

LAW

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Group-A

Answer question No. 1 and *any three* questions from the rest of the Group-A.

1. Write short notes on *any four* of the following: 5×4=20

   (a) ubi jus ibi remedium

   (b) Inevitable accident

   (c) Volenti non fit injuria

   (d) Wrongful gain

   (e) Document

   (f) Dishonestly

2. (a) Explain Malfeasence, Misfeasence and Nonfeasence with suitable examples. 12

   (b) Make a distinction between Intention and Motive. 8

3. (a) Distinguish between 'giving false evidence' and 'fabricating false evidence'. 12

   (b) Write a critical note on *Mens rea*. 8

4. Explain in brief the various theories of Punishment under the Indian Penal Code. 20

5. (a) Define and illustrate 'extortion' and distinguish it from theft. 15

   (b) *A* makes an attempt to pick the pocket of *Z* by thrusting his hand into *Z*'s pocket. *A* fails in the attempt in consequence of *Z*'s having nothing in the pocket. Is *A* liable for any offence? 5

6. (a) Make a distinction between 'Common intention' and 'Common object'. 10

   (b) Comment in brief on 'Criminal Conspiracy'. 10

Group-B

Answer question No. 7 and *any three* from the rest of the Group-B.

7. Write short notes on *any four* of the following: 5×4=20

   (a) Unenforceable Contract

   (b) Supervening impossibility in a Contract

   (c) Wagering Agreement

   (d) Quasi Contract

   (e) Quantum Meruit

   (f) Partnership at Will

8. (a) Define the term Offer. Explain the Legal rules regarding Offer. 10

   (b) Distinguish between offer and invitation to make an offer. 10

9. (a) What is undue influence? How does it differ from coercion. 12

   (b) Comment on "ignorance of Law is no excuse". 8

10. (a) Define Partnership. How does it differ from Co-ownership? Can a Partnership be created orally? Can a Minor be a partner in a Partnership firm. 6+6+2+2=16

    (b) *X* a publisher agrees to publish at his own expense a book written by *Y* and to pay *Y* half of the net profits. Is there a partnership between *X* and *Y*? 4

11. (a) Explain the various modes of Creation of an Agency. Mention the different kinds of Agent. 12

    (b) Point out the modes for termination of Agency by operation of Law. 8

12. (a) Discuss the various remedies available for breach of contract. Distinguish between liquidated damages and penalty. 12

    (b) 'N'a filmstar agreed to act exclusively for 'W' and for none else for a period of one year. During the year 'N' also contracted to act for one 'C'.

    Has 'W' any remedy against 'N'? 8

Group-C

Answer question No. 13 and *any one* from the rest of the Group-C.

13. Write short notes on *any four* of the following: 5×4=20

(a) Disproved

(b) Accomplice

(c) Fact in issue

(d) Hearsay evidence

(e) Leading question

(f) Judgement in rem

14. (a) What is a dying declaration? 6

(b) What is the effect of dying declaration when the person making it does not die? 6

(c) What is the value of a dying declaration? 8

15. (a) Who are competent to testify? 6

(b) Are the lunatic, dumb, husband and wife competent to testify? 8

(c) Discuss the value of the evidence given by a child. 6

2021

PHILOSOPHY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be written either in **English** *or in* **Bengali** *but all answers must be in one and same language.*

Answer any five *questions taking at least* two *from each group.*

Group-A

1. How does Descartes arrive at the principle, 'I think, therefore I am'? Is it an inferential truth? Discuss. 30+10=40

2. (a) Critically discuss Leibnitz's theory of monads. In what sense does it differ from Democritus' concept of atom?

(b) Why did Leibnitz describe the monads as 'windowless'? (15+15)+10=40

3. (a) What are innate ideas?

(b) How does Locke refute the doctrine of innate ideas?

(c) What is the influence of this refutation on his theory of knowledge? 5+25+10=40

4. Write short notes on *any two* of the following: 20×2=40

(a) Plato's theory of Ideas

(b) Berkeley's view on 'Abstract Ideas'

(c) Kant's theory of a priori knowledge

(d) Verifiability theory of meaning

Group-B

5. Discuss *nairātmyavāda* of the Buddhists. Is this view consistent with their doctrine of *karma*? 30+10=40

6. Explain the nature of *Vyāpti* after the Nyāya Philosophy. How is *Vyāpti* known?— Discuss critically. 20+20=40

7. Explain the nature of Brahman according to Ācārya Saṅkara. 40

8. Write notes on *any two* of the following: 20×2=40

(a) *Syādvāda*

(b) Cārvāka concept of soul

(c) Sāṁkhya concept of *Puruṣa*

(d) Practical Vedānta

2021

ECONOMICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Answer 5 questions, taking at least 2 from each group.

Group-A

1. (a) "If more of a commodity is demanded when income alone increases, less of the commodity must be demanded when its price alone rises." Consider a consumer in a two-commodity framework and establish the statement using the concepts of income and substitution effects.

   (b) (i) What is the 'Weak Axiom of Revealed Preference' (WARP)?

   (ii) In a 2-commodity framework, a consumer purchased 10 units of X & 10 units of Y, when the prices were Rs. 10/ unit of X and Rs. 10/ unit of Y. The consumer is found to have purchased 8 units of X and 12 units of Y, when the prices changed to Rs. 12/ unit of X and Rs. 9/ unit of Y. Has the consumer violated the WARP? 20+(8+12)=40

2. (a) Distinguish between the long-run equilibrium of a firm under perfect competition and that of a firm under monopolistic competition. Explain your answer with appropriate diagram(s).

   (b) Explain the relation between the short-run and long-run marginal cost curves. Posit an appropriate diagram. 20+20=40

3. (a) Assume a 2-person economy with a given endowment vector of 2 private goods — X and Y. Intuitively explain the Pareto optimality condition for the economy. Hence derive the 'Utility Possibility Frontier' (UPF) of the economy.

   (b) Define 'Economic Rent' and prove that the amount of economic rent earned by a factor varies inversely with the elasticity of factor-supply. Posit an appropriate diagram. (12+8)+(8+12)=40

4. (a) Distinguish between 'planned or ex-ante investment' and 'realised or ex-post investment' and relate the distinction to the difference between 'saving-investment equality' and 'saving-investment identity'.

   (b) What is the 'paradox of thrift'? Does the amount of private savings necessarily decrease if everybody in the economy try to save more. (8+12)+(8+12)=40

5. (a) State and explain the Law of Walras in the Hicks-Hansen IS-LM model of simultaneous determination of the national income and the rate of interest.

(b) Analyse the counter-recessionary impacts additional government expenditure in the IS-LM model under the following two scenario:

(i) the Central Bank keeps the stock of money supply unchanged;

(ii) the Central Bank raises the money stock to keep the interest rate unchanged.

20+20=40

Group-B

6. (a) "As an economy moves from autarchy to free trade, the distribution of national income must move in favour of the factor used relatively intensively in the export sector." Use the standard Heckscher - Ohlin model to evaluate the proposition.

(b) Consider the following two production functions:

(i) $Y = L^3 . K^2$ and

(ii) $Y = L^{2/3} . K^{1/3}$, where L = labour, K = capital and Y = real national income.

Which of the two production functions would you recommend for analysing the 'Solow Steady state' and why? Explain your answer. 20+20=40

7. (a) Consider an economy with one private good X and one public good G. Given the endowments of labour and capital, the production functions for X and G and the utility functions of two persons — A and B how would you find out the Pareto - optimal amounts of X and G for the economy? Explain your answer.

(b) Use the partial equilibrium approach to distinguish between a positive externality and a negative externality. Hence analyse the significance of the Pigou tax-subsidy paradigm.

20+(12+8)=40

8. (a) Explain the difference between the 'Covered Interest Parity' and the 'Uncovered Interest Parity' conditions and spell out their significance in the analysis of inter-country capital movements.

(b) "Public debt has no burden." Do you agree? Explain your answer. (10+10)+20=40

9. (a) (i) If a variable x takes the values 1, 2, ____, r with $F_1, F_2, \_\_\_\_, F_r (= n)$ as the corresponding less than type cumulative frequencies, then prove that

$$\bar{x} = (r+1) - \frac{1}{n}\sum_{i=1}^{r} F_i$$

(ii) For two values, say 'a' and 'b', $a < b$, of a variable x, the mean and standard deviation are 25 and 4 respectively. Find 'a' and 'b'.

(b) (i) Posit and explain the 'classical definition of probability' and identify its limitations.

(ii) Distinguish between 'simple random sampling with replacement' (SRSWR) and 'simple random sampling without replacement' (SRSWOR). Give appropriate examples.

(10+10)+(4+6)+10=40

10. (a) Briefly explain the method of 'Point Estimation' in statistical inference and identify the properties of a 'minimum-variance unbiased estimator' (MVUE).

(b) If $4U = 2x + 7$ and $6V = 2y - 15$, and the regression coefficient of y on x is 3, then find out the regression coefficient of V on U.

(10+10)+20=40

2021

ECONOMICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Group-A

Answer *any three* questions.

1. Write short notes on: 20×2=40

   (a) Effects of Green Revolution on Environment in India.

   (b) Effects of Gender Inequalities on Health.

2. Discuss the economic consquences of Partition on the state of West Bengal. 40

3. What were the major changes in fiscal policy that took place in the Indian economy in the post 1991 period? 40

4. What was the impact of commercialization of agriculture on Indian economy in the pre-independence period? 40

5. According to Asian Development Bank, "21·9% of the population lives below the national poverty line in 2011." Give your views on the causes of persistent poverty in spite of numerous poverty alleviation programmes launched by the Government of India. 40

Group-B

Answer *any two* questions.

6. Give a brief overview of the TRIPs Agreement of WTO. 40

7. What is Human Development Index? How is it calculated? Why is it more relevant to use HDI than income to measure the state of development of a country? 10+20+10=40

8. Why is environmental protection necessary for sustainable development? 40

2021

PHYSICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) If T be the instantaneous kinetic energy of a moving body of mass m, show that $\frac{d}{dt}(mT) = \vec{F}.\vec{p}$, where $\vec{F}$ is the force acting on the body and $\vec{p}$ is the linear momentum.

   (b) What do you mean by non-inertial frame? Show that the eastward deflection due to effect of coriolis force on a freely falling body at a height 'h' from the earth's surface, initially at rest, is proportional to $h^{3/2}$.

   (c) Show that for a particle moving under a central force, total energy is conserved.

   (d) State the conservation of angular momentum of a system of particles. Show that centre of mass of a system of particles is unique.

   (e) Two particles of masses m_1 and m_2, initially at rest at infinite distance from each other, move under the action of mutual gravitation pull. Show that at any instant their relative velocity of approach is $\sqrt{\frac{2G(m_1+m_2)}{R}}$, where R is the separation at that instant.

   4+(2+10)+8+(3+5)+8=40

2. (a) Mention the advantages of using generalized coordinates in classical mechanics.
   In an inverted pendulum, particle of mass m is attached to a rigid massless rod of length l. If the vertical motion (along Z-axis) of the point of suspension is represented by $Z=a\sin\omega t$, 'a' being a constant, set up the Lagrangian and obtain the equation of motion.

   (b) Write down Euler's equations of motion for a torque-free motion of a rigid body and obtain principle of conservation of total rotational kinetic energy.

   (c) Show the graphical variation of gravitational potential and field inside and outside of a solid sphere (V and E in a single plot).

(d) A half-disc of mass M and radius R rotates about an axis that passes through the centre of the straight side and is perpendicular to its plane. Find moment of inertia about the axis of rotation.

(e) Show that for a cantilever of negligible weight, the depression at any point P due to a load applied at the free end point Q is the same as the depression at Q produced by a similar load at P. (3+7)+(3+7)+6+6+8=40

3. (a) Write down the postulates of special theory of relativity.

(b) Write down the transformation equations of $\vec{P}$ and E in relativistic mechanics. Assume that the S' frame is moving with a velocity v along x-axis with respect to another inertial frame S.

Prove that $E^2 = p^2C^2 + m_0^2C^4$ is invariant under Lorentz transformation, where the terms have their usual meanings.

(c) A spaceship moving away from the earth with velocity 0·5C fires a rocket whose velocity relative to the space is 0·5C (i) away from the earth, (ii) towards the earth. Calculate the velocity of the rocket as observed from the earth in two cases.

(d) Define group velocity and phase velocity of a wave. A wave packet in a certain medium is constructed by superposing waves of frequency ω arount $\omega_0 = 100$ and the corresponding wave number K with $K_0 = 10$ as given in table below :

ω (s^{-1})	$K(m^{-1})$
81.00	9.0
90.25	9.5
100.00	10.0
110.25	10.5
121.00	11.0

Find the relation between v_g / v_p where v_g is the group velocity and v_p is the phase velocity.

(e) A particle of mass m is oscillating along x-axis under the action of a restoring force proportional to the displacement from the position of equilibrium and a damping force proportional to the instantaneous velocity. Write down the equation of motion of the particle and solve it for the case of critical damping. 4+(6+6)+6+6+(3+9)=40

4. (a) State Fermat's principle in geometrical optics. Obtain laws of refraction at a spherical surface from it.

(b) Obtain focal length of a combination of two thin lenses (foci f_1 and f_2) separated by a distance t using system matrix.

(c) In Newton's ring arrangement, a source emitting two wavelengths $\lambda_1 = 6\times10^{-7}$ m and $\lambda_2 = 5{\cdot}3\times10^{-7}$m. It is found that mth dark ring due to one wavelength coincides with $(m + 1)$th dark ring due to the other. If the radius of curvature of the lens is 0·9 m, find the diameter of the mth dark ring.

(d) The central circle of a zone plate has a radius of 0·07 cm. Light of 5000Å coming from an object 147 cm away from the plate falls on it. Find the position of the principal image.

(e) Two linearly polarized light waves are in phase but having different amplitudes, represented by

$$\overrightarrow{E_1}(z,t) = \hat{i}A_1\cos(kz-\omega t) + \hat{j}B_1\cos(kz-\omega t)$$

$$\overrightarrow{E_2}(z,t) = \hat{i}A_2\cos(kz-\omega t) + \hat{j}B_2\cos(kz-\omega t)$$

Find the nature and direction of polarization of $\vec{E} = \overrightarrow{E_1} + \overrightarrow{E_2}$. (3+9)+8+6+6+(3+5)=40

5. (a) Obtain Coulomb's law from Gauss's law in electrostatics.

(b) A cylindrical electron beam has a circular cross section of radius a and charge density $\rho(r) = \rho_0\left(1 + r^2/a^2\right)$. Find electric field at any internal point ($r<a$).

(c) State Ampere's circuital law. Verify this law for a long straight wire current carrying conductor.

(d) Write down Faraday's law of electromagnetic induction in integral form and obtain its differential form.

(e) An electromagnetic wave in free space with no electric charges or current is represented by $H_x = H_y = 0$ and $H_z = \frac{B}{\mu_0} = A\sin(\alpha y)\cos(\omega t); \alpha =$ a constant. Determine the accompanying electric field $\vec{E}$ and the pointing vectors $\vec{S}$. 6+8+(3+5)+(2+4)+(8+4)=40

6. (a) In a LCR circuit supplied with an ac source of constant angular frequency ω, the value of c is varied continuously. When the current is maximum the value of c is c_0 . When the current falls to $\frac{1}{\sqrt{2}}$ of its maximum value, the values of c are c_1 and c_2. Show that $\frac{1}{c_1}+\frac{1}{c_2}=\frac{2}{c_0}$.

(b) What do you mean by 'entropy' of a system? Prove the relation $Tds = C_p dT - T\left(\frac{\partial V}{\partial T}\right)_p dp$, where the terms have their usual meanings.

(c) Mention two difference between reversible adiabatic expansion and Joule-Thomson expansion.

(d) Calculate the variation of C_p with pressure at constant temperature of a substance for which the equation of state is given by $V=\frac{RT}{P}-\frac{C}{T^3}$.

(e) One gm of water vapour at 100°C and atmospheric pressure occupies a volume 1640 cc. Find the vapour pressure of water at 99°C in terms of mm-Hg. Given L=536 cal.

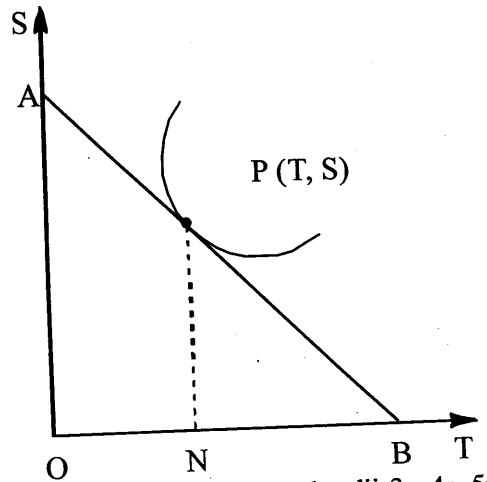
10+(3+5)+4+10+8=40

Group-B

Answer *any two* questions.

7. (a) Define Poisson's ratio. What are the limiting values of it? Why it can not have a negative value?

(b) The plot of surface tension (S) with temperature (T) is shown below with origin O at (T = 0, S = 0). Prove that the intercept of the tangent to the curve with the S-axis at any point is equal to the surface energy per unit area at the corresponding temperature.



(c) Three capillaries of same length but internal radii 3r, 4r, 5r are connected in series and a liquid flows through them in stream line condition. If the pressure difference across the third capillary is 8·1mm, find the pressure difference across the first capillary.

(d) A point mass m is placed on a frictionless plane that is tangent to Earth's surface. Determine Hamilton's equations.

(e) In the Lorentz transformation of space time coordinates, there is a plane in S on which the clock agrees with those of S' after time t. S' is moving with a velocity v with respect to S along the common x-axis. Find the velocity of the plane in S frame.

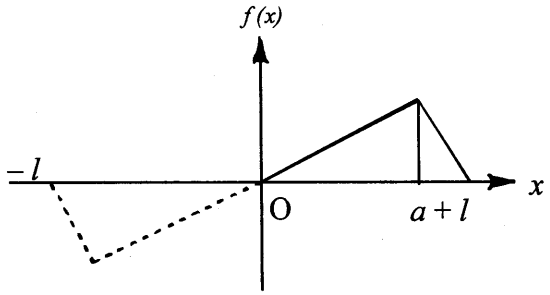
(3+2+2)+10+6+10+7=40

8. (a) Show that two rectangular SHMs of equal frequency but having a phase difference of $\pi/2$ can generate a circular motion.

(b) The vibration of a plucked string is given by

$$f(x)=\frac{hx}{a} \text{ for } 0<x<a$$

$$=\frac{h(l-x)}{(l-a)} \text{ for } a<x<l$$



where a, h, l are all constants as shown in fig.

Find the Fourier analysis of the function.

(c) In Young's double-slit experiment, show that the fringe width for both bright and dark fringes are equal.

(d) Light falls normally on a transparent diffraction grating of width l = 6·5cm with 200 lines per millimetre. The spectrum under investigation includes a spectral line with λ = 670·8nm consisting of two components differing by dl = 0·015nm. Find in what order of the spectrum these components will be resolved.

(e) Obtain the relation connecting Y, η and σ, where the terms have their usual meaning.

6+10+10+6+8=40

9. (a) Obtain mutual potential energy between two dipoles when they lie along the same line on a plane.

(b) Consider a sphere of radius a made of inhomogeneous dielectric whose dielectric constant is given by

$$K = \frac{1}{1+Ar},$$

where A is a constant and r is the radial distance. A charge q is placed at the centre of sphere. Find $\vec{D}$, $\vec{E}$ and $\vec{P}$ at any internal point. Also find the polarization charge densities.

(c) Two similar point charges q, q are kept separated by a distance $2d$ in air. An insulated uncharged conducting sphere of radius a is placed midway between them. If $d>>a$, show that the introduction of the sphere reduces the force experienced by either point charge to $\left(1-24\frac{a^5}{d^5}\right)$ of its initial value.

(d) Consider a toroidal coil of N turns wound uniformly on a form of non-magnetic material with square cross-section of side a. If the mean radius of toroid is R, considering variation of B over the cross-sectional area, show that the self-inductance is given by

$$L = \frac{\mu_0 a N^2}{2\pi} ln \frac{R+\frac{a}{2}}{R-\frac{a}{2}}.$$

(e) If the electrostatic potential at a point (x, y) is given by $V = 2x + 4y$ volts, find the electrostatic energy density. 6+(3+3+6)+10+8+4=40

10. (a) A source of constant voltage V is connect with a capacitor C and a resistor R in series. Obtain an expression of rate of charging in the circuit. Obtain voltage drops across R and C and show their variation with time.

(b) What do you mean r.m.s. value of an ac? Find an expression of it in terms of the peak value of the ac.

(c) Write down Maxwell equations of electromagnetism (in SI units).

(d) State Gibb's phase rule.

Obtain Clausius-Clapeyron's equation in connection with the change of phase due to pressure.

(e) Prove the relation $C_P - C_V = -T\dfrac{\left(\dfrac{\partial V}{\partial T}\right)_P^2}{\left(\dfrac{\partial V}{\partial P}\right)_T}$. (6+3+3)+(3+5)+6+(3+5)+6=40

2021

PHYSICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any six* questions.

1. State and prove the equipartition theorem. 2+8=10

2. For a massless extreme relativistic gas of N particles find the partition function. Comment on the validity of the equipartition theorem in this particular case. 7+3=10

3. Find the entropy of a non-interacting gas using microcanonical ensemble. 10

4. (a) Draw the circuit diagram to study the common-emitter mode characteristics of a transistor.

   (b) Draw the typical common-emitter output characteristics of a p—n—p transistor and explain those. 5+5=10

5. The saturation current density of a p—n junction germanium diode is 250 mA/m^2 at 300°K. Find the voltage that would have to be applied across the junction to cause a forward current density of 10^5 A/m^2 to flow. 10

6. (a) Draw the energy spectrum of the β-particle in β-decay. Explain the origin of its continuous nature.

   (b) Indicate the fundamental interaction through which the following processes occur: (3+4)+3=10

   (i) $n \rightarrow p + e^- + \bar{\nu}$

   (ii) $p + p \rightarrow p + p + p + \bar{p}$

   (iii) $\gamma \rightarrow e^+ + e^-$

7. (a) Discuss the evidences in favour of the nuclear shell model.

   (b) Explain how the liquid drop model can explain the phenomenon of nuclear fission. 5+5=10

8. (a) Define group velocity and phase velocity. Obtain a relation between the two.

   (b) Show that the eigenvalues corresponding to a hermitian operator is real. (2+2+4)+2=10

9. Using Debye's theory, find out an expression for specific heat of solids. Explain how it differs from classical theory. 7+3=10

Group-B

Answer *any seven* questions.

10. (a) Calculate the canonical partition function Q_1 for a single classical simple harmonic oscillator with Hamiltonian

$$H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 x^2$$

   (b) Hence compute the partition function for N distinguishable oscillators as $Q_N = Q_1^N$. Find S, P, μ, U, C_p and C_V. Comment on the validity of equipartition theorem. The symbols have their usual meaning. 8+12=20

11. In the theory of paramagnetism, the Hamiltonian can be written as

$$H = -\sum_{i=1}^{N} \vec{\mu}_i . \vec{B}$$

   (a) Treating the system classically find the magnetic moment at a temperature T.

   (b) Treat the system quantum mechanically where $\vec{\mu} = g_J \mu_B \vec{J}$. The z-component of $\vec{J}$ can be $m = -J, -J+1, \ldots\ldots\ldots\ldots, J-1, J$. Find the magnetic moment at a temperature T and obtain the expression for the Curie constant at high temperature. 10+10=20

12. (a) For a two level system, with total number of particles N, energy U and allowed energy levels 0 and ϵ, find the U as a function temperature T.

   (b) Consider a classical gas of hard spheres of diameter σ. When a particle is added to the system of N particles, the volume available to the new particle is not V but somewhat less. Assuming that $N\sigma^3 << V$, determine how the number of microstates Ω (N, V, E) depends on V. Also show that as a result of this, V in the gas law $PV = Nk_BT$ gets replaced by $(V - b)$ where b is equal to four times the actual space occupied by the sphere. 8+12=20

13. (a) State four characteristics of an OP AMP.

   (b) Draw the circuit diagram of a non-inverting amplifier using an OP AMP. Derive an expression for the gain of the amplifier.

   (c) Draw the circuit diagram of an integrator using an OP AMP. Derive an expression for the output voltage. 4+(4+4)+(4+4)=20

14. (a) Prove the following Boolean identities:

(i) $\overline{AB+BC+CA}=\bar{A}\bar{B}+\bar{B}C+\bar{C}A$

(ii) $A(A+\bar{B}C)+A(\bar{B}+C)=A$

(iii) $(A+\bar{B})(\bar{A}+C)=AC+\bar{A}B$

(b) Design a logic circuit to implement the following:

$$Y=ABC+\bar{A}B+\bar{A}C$$

(c) Sketch the circuit for a NOR gate using diodes and transistors and explain its working.

(4+4+4)+3+5=20

15. (a) Write down the semi-empirical mass formula. Explain its different terms. Explain from the mass formula why odd-odd nuclei are rare in nature.

(b) Draw the $I_3 - Y$ plot of the octet of pseudoscalar mesons indicating the respective particles.

(3+8+2)+7=20

16. (a) Write down the one dimensional Schroedinger equation for a particle under a step potential given as $V = 0$ for $x < 0$ and $V = V_0$ for $x > 0$.

(b) State the boundary conditions.

(c) Solve the equation for both the regions assuming the particle energy $E > V_0$.

(d) Find the probability current density for incident, reflected and transmitted waves.

(e) Find the transmission and reflection coefficient. 2+2+6+6+4=20

17. (a) Sketch a one dimensional harmonic oscillator potential. Write down the energy eigenvalues. Sketch the wave function for the first three states.

(b) Consider a two dimensional symmetric harmonic oscillator with frequency ω. Find out the degeneracy of the state with energy $5\hbar\omega$.

(c) Write down coordinate space representation of the operators L_x and L_y. Find their commutation relations using the commutation relation of position and momentum.

(d) Show that the eigenfunctions corresponding to two different eigenvalues of an operator are orthogonal to each other. (2+2+3)+2+(2+4)+5=20

18. (a) Discuss the band structure of metals, conductors and semiconductors.

(b) Obtain an expression for Hall Voltage in a intrinsic semiconductor sample.

(c) Distinguish between ferromagnetism, diamagnetism and paramagnetism. 8+6+6=20

19. (a) Describe the feature of anomalous Zeeman effect that could not be explained classical theory.

(b) What are Stokes and anti-Stokes lines?

(c) The uncertainty in the mass measurement of an elementary particle is 1 MeV. Estimate its lifetime.

(d) A $^{7}_{3}Li$ nucleus is bombarded with protons and α-particles are emitted in the reaction. Calculate the kinetic energy of the α-particle assuming the kinetic energy of the bombarding proton to be negligible. [Given M($^{7}_{3}Li$) = 7.016004 a.m.u., M(p) = 1.007826 a.m.u. and M(α) = 4.002603 a.m.u.]

(e) What is Meissner effect in superconductivity? 6+4+3+4+3=20

(c) Let the p.d.f. of the joint distribution of $X_1, X_2, \ldots, X_p$ be

$$\frac{1}{\left(\sqrt{2\pi}\right)^p} e^{-\frac{1}{2}\Sigma x_i^2} \left\{1+\prod_{i=1}^{p} x_i \; e^{-\frac{1}{2}\sum_1^p \left(x_i^2-1\right)}\right\}; \; -\infty < x_i < \infty \; \forall i.$$

Find the marginal distribution of X_i, $i = 1, 2, \ldots, p$. 8+14+8=30

4. (a) State and prove the Fisher-Neyman factorization theorem in the discrete set-up.

(b) Show that the largest order statistic in a random sample $(X_1, X_2, \ldots, X_n)$ from a distribution with pmf $P(X=k)=\frac{1}{N}, k=1, 2, \ldots, N$, N being a positive integer, is sufficient for N. 16+14=30

5. (a) Let $\cup$ be the class of all unbiased estimators of θ with $E_\theta\left(T^2\right) < \infty$ for all θ and suppose $\cup$ is non-empty. Let $\cup_0$ be the class of all unbiased estimator T_0 of 0, i.e.

$$\cup_0 = \left\{T_0 : E(T_0) = 0, E_\theta\left(T_0^2\right) < \infty \; \forall \; \theta\right\}.$$

Then prove that T is UMVUE if and only if $E_\theta(T\,T_0) = 0$ for all θ and all $T_0 \in \cup_0$.

(b) Let $(X_1, X_2, \ldots, X_n)$ form a random sample from the rectangular distribution with pdf $f_\theta(x)=\frac{1}{\theta}, 0 < x < \theta; 0 < \theta < \infty$. Show that $Y=\frac{n+1}{n}X_{(n)}$ is the UMVUE of θ with $\mathrm{Var}(Y) = \theta^2/n(n+2)$ which is less than the Cramer-Rao lower bound, ($X_{(n)}$ is the largest order statistic). 15+15=30

6. (a) In connection with testing statistical hypotheses, define (i) uniformly most powerful (ii) unbiased (iii) uniformly most powerful unbiased critical regions.

(b) Let X~ Normal (0.1) under H_0 and X~ Cauchy with pdf $f(x)=\frac{1}{\left(1+x^2\right)}$, $-\infty < x < \infty$. Find an MP test for H_0 against H_1.

(c) For testing $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$, show that there exists a non-negative constant k such that a critical region W_0 defined by

$$W_0 = \left\{(x_1, \ldots, x_n) / f_{\theta_1}(x_1, \ldots, x_n) / f_{\theta_0}(x_1, \ldots, x_n) > k\right\}$$

satisfies $\int_{W_0} f_\theta(x_1, \ldots, x_n)\, dx_1, \ldots, dx_n = \infty$

Also show that W_0 is an MP critical region for testing H_0 against H_1. (Assume that $f_{\theta_1}(X_1, X_2, \ldots, X_n) / f_{\theta_0}(X_1, X_2, \ldots, X_n)$ is continuous.) 6+12+12=30

2021

STATISTICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any four* questions.

1. (a) Give the axiomatic definition of probability. Describe how the limitations of classical definition of probability are taken care of. Also show that the classical definition of probability can also be obtained from this definition in particular case.

   (b) State and prove Poincaré's theorem on probability of occurrence of at least one of the events $A_1, A_2, \ldots, A_n$.

   (c) A player tosses an unbiased coin n times on the condition that he gains Re. 1 if he casts 'Head'; otherwise he looses Re. 1. Find the probability he neither looses nor gains. 7+15+8=30

2. (a) Define a random variable and its cumulative distribution function (CDF). Show that a CDF is non-decreasing. If F is a CDF then show that $G(x)$ defined by $G(x)=\frac{1}{2h}\int_{x-h}^{x+h} F(y)dy$ is also a CDF.

   (b) Prove the following recursion relation among the central moments of $N(\mu,\sigma^2)$, (a normal distribution with mean μ and variance σ^2)

   $\mu_{r+1}=\sigma^3\frac{d\mu_r}{d\sigma}+\sigma^2\mu_r.\quad r=0,1,2,\ldots.$

   Hence find the first four central moments. 18+12=30

3. (a) Let $\{X_n\}, n=1, 2, \ldots$ be a sequence of random variables. When is $\{X_n\}$ said to obey weak law of large numbers (WLLN)? Let $(X_1, X_2, \ldots, X_n)$ form a random sample from a Bernoulli distribution. Show that the sample proportion of successes converges in probability to the population proportion.

   (b) Let X be an absolutely continuous random variable. Show that

   $$\sum_{n=1}^{\infty}\text{Prob}\left(|X|\geq n\right)\leq E|X|\leq 1+\sum_{n=1}^{\infty}\text{Prob}\left(|X|\geq n\right).$$

Group-B

Answer *any two* questions.

7. (a) Consider simple random sampling with replacement SRSWR of size n from a population of size N. Find the first and second order inclusion probabilities.

(b) Show that the sample mean $\bar{y}$ based on an SRSWR of size n can be expressed as $\bar{y} = \sum_{1}^{N} t_i \, Y_i / n$, where $(t_1, t_2, \ldots, t_N)$ follows a multinomial distribution. Hence find $E(\bar{y})$ and $\text{Var}(\bar{y})$.

(c) Let $\bar{y}'$ be the sample mean based on distinct units of an SRSWR of size n. Show that $E(\bar{y}') = \bar{Y}$, $\text{Var}(\bar{y}') \le \text{Var}(\bar{y})$ where $\bar{Y}$ and $\bar{y}$ have usual meaning. 10+15+15=40

8. (a) Consider the model $E(y_{ij}) = \mu + \alpha_i + \beta_j, i = 1, 2, \ldots, p; \; j = 1, 2, \ldots, q; \; \sum_{i=1}^{p} \alpha_i = 0 = \sum_{j=1}^{q} \beta_j$.

Define $\hat{\alpha}_i = y_{i0} - y_{00}, \hat{\beta}_j = y_{0j} - y_{00}, \hat{\mu} = y_{00}$

where $y_{i0} = \sum_{j=1}^{q} y_{ij} / q, \; y_{0j} = \sum_{i=1}^{p} y_{ij} / p, \; y_{00} = \sum_i \sum_j y_{ij} / pq$.

Prove the following identity

$$\sum_i \sum_j (y_{ij} - \mu - \alpha_i - \beta_j)^2 = SS_e + q \sum_i (\hat{\alpha}_i - \alpha_i)^2 + p \sum_j (\hat{\beta}_j - \beta_j)^2 + pq(\hat{\mu} - \mu)^2$$

where $SS_e = \sum_i \sum_j (y_{ij} - y_{i0} - y_{0j} + y_{00})^2$. Use the identity to find

(i) the least squares estimates of μ, α_i and β_j,

(ii) sum of squares (s.s) due to $H_{01} : \alpha_i = 0 \; \forall i$; s.s due to $H_{02} : \beta_j = 0 \; \forall j$ and

(iii) to prove the partition of s.s

$$\sum_i \sum_j (y_{ij} - y_{00})^2 = q \sum_i (y_{i0} - y_{00})^2 + p \sum_j (y_{0j} - y_{00})^2 + SS_e .$$

Construct the tests for H_{01} and H_{02} with usual assumptions on $\{y_{ij}\}$.

(b) Consider the one-way classification model $E(y_{ij}) = t_i, \; j = 1, 2, \ldots, n_i, \; i = 1, 2, \ldots, k$,

where $\text{Cov}(y_{ij}, y_{i'j'}) = 0$ if $i \ne i'$

$= 0$ if $j \ne j'$ when $i = i'$

$= \sigma^2$ if $i = i', \; j = j'$.

Assume that $\sum_{1}^{k} n_i = n = k.p$ plots are available for experimentation. Determine n_is so that $\sum_{i=1}^{k} \text{Var}(\hat{t}_i)$ is minimum, where $\hat{t}_i$ is the least squares estimator of t_i (p is a positive integer). 20+20=40

9. (a) Suppose 5 fodders are to be tested for increasing yield of milk. 25 cows are available which are divided into 5 age groups and 5 breeds. Describe a statistical design so that the fodders can be effectively tested. Give the layout of the design without randomisation. Also give the analysis of the observations arising out of the design.

(b) Construct a confounded balanced $(2^3, 2)$ plan where all the interactions are balanced. (Use minimum number of replications and give the confounding plan only.)

(c) Describe the Yates' method of computing the factorial effects (including the total effect) in a 2^2 factorial experiment from the treatment effects. Show that Yates' method is based on the algebraic relation

$$\begin{pmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & 1 \end{pmatrix}^2 = \begin{pmatrix} 1 & 1 & 1 & 1 \\ -1 & 1 & -1 & 1 \\ -1 & -1 & 1 & 1 \\ 1 & -1 & -1 & 1 \end{pmatrix}.$$

20+10+10=40

2021

STATISTICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

1. Answer *any ten* questions: 10×10=100

(a) What do you mean by rational sub-groups in a statistical process control? Explain the theoretical basis of control charts.

(b) Distinguish between:

(i) Defect and Defective (ii) Process Control and Product Control

(c) Describe control charts for number of defects.

(d) What are the errors that we often come across while constructing a price index number? —Discuss in brief.

(e) Define Laspeyres' price index. It has an upward bias. — Justify. Does the formula satisfy the tests for index numbers?

(f) Distinguish between Edgeworth-Marshall formula and Fisher's ideal formula for price index.

(g) Indicate the types of error that are usually found to occur in census data on age.—Discuss.

(h) Distinguish between Neonatal and Perinatal mortality rates.

(i) What do you mean by a Life table? Write down the uses of such a table.

(j) Simple moving average method over estimates the trend values when the true trend is a convex function.—Justify. How do you choose the period of moving average?

(k) Write a note on exponential smoothing method of forecasting.

(l) Describe the ratio to trend method in estimating the seasonal component.

(m) What is Pareto's law? Formulate Pareto probability density using the law. Find Gini's mean difference in this case.

(n) Citing an example describe the method of graphical solution in a simple linear programming problem.

(o) What are the functions of West Bengal Bureau of Applied Economics and Statistics?

Group-B

2. Answer *any five* questions: 20×5=100

   (a) Distinguish between natural tolerance limits and specification limits. What do you mean by process capability?

   (b) How do you modify the control limits when the process is at desired state of control and the control limits for mean are well within the specification limits? (6+4)+10=20

3. (a) Discuss the following concepts in connection with sampling inspection plans for attributes : AOQ, AOQL, ATI and ASN.

   (b) What is OC curve? Draw an ideal OC curve. What is indifference quality level?

   (c) Distinguish between incoming quality and outgoing quality. (3+3+3+3)+(2+2+2)+2=20

4. (a) Describe control charts for fraction defectives based on variable sample size.

   (b) Show that 2 × Lorenz area = Gini coefficient of concentration. 10+10=20

5. (a) What are the implications of TFR, GRR and NRR?

   (b) The assumption of relative growth rate of population being constant is unrealistic. — Explain.

   (c) What do you mean by indirect method of standardization in determining STDR? (3+3+3)+5+6=20

6. (a) Derive, by starting from a suitable functional form for l_x, the following:

   (i) $L_x = \frac{l_x + l_{x+1}}{2}$ (ii) $L_x = \frac{-dx}{ln\, p_x}$

   (b) Show that :

   (i) $\frac{e_x\, e_{x+1} \cdots e_{x+n-1}}{(1+e_{x+1})(1+e_{x+2}) \ldots (1+e_{x+n})} = {}_nP_x$

   (ii) $L_x = l_{x+1} + \int_0^1 t\left(-\frac{d}{dt} l_{x+t}\right) dt$ (5+5)+(5+5)=20

7. (a) Define serial correlation and correlogram. What are the uses of correlogram?

   (b) Obtain the correlogram of Yule's process. Discuss all the cases. (2+2+6)+10=20

8. (a) What do you mean by a stationary time series? Define weak stationarity.

   (b) What are the effects of moving average on irregular component?

   (c) Moving averages can adopt themselves to changing circumstances.— Explain. (3+3)+8+6 = 20

9. (a) Distinguish between NDP and NNP.

   (b) Write a note on the role of NSSO.

   (c) Discuss in brief the production approach in computing National income. 4+6+10 = 20

2021

ENGLISH

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Group-A

1. Write an essay on *any one* of the following topics: 40

   (a) Poetry is the criticism of life

   (b) Art for Art's Sake

   (c) Social Responsibility of a Dramatist

   (d) Literary value of Travelogue

   (e) Feminism in Literature

Group-B

2. Answer *any two* of the following questions: 40×2=80

   (a) Bring out the complexities of Lady Macbeth's character in Shakespear's *Macbeth*.

   Or,

   Do you consider Marlowe present the character of Edward-I, qualifies Edward as Renaissance tragic hero? Substantiate your answer.

   (b) Critically analyse John Donne as a Metaphysical love poet with special reference to 'The GoodMorrow'.

   (c) Analyse the innovative treatment of the salient features in Satan's character in Milton's *Paradise Lost* Book I.

   (d) Give a character sketch of Belinda as Pope presented her in the heroi-comical poem *The Rape of the Lock.*

   (e) 'If winter comes, can spring be far behind?' Analyse Shelley's revolutionary idealism in 'The Ode to the West Wind' in the light of the above lines.

   (f) What is a 'dramatic monologue'? Will you consider 'The Last Ride Together' to be a successful dramatic monologue? Give reasons for your answer.

Group-C

3. Answer *any two* from the following questions: 40×2=80

(a) Analyse Pip's growth and education in Charles Dickens' *Great Expectations*.

(b) Justify the title of Jane Austen's novel *Pride and Prejudice*.

(c) Write an essay on Hardy's tragic philosophy as revealed through his use of chances and coincidences in *The Mayor of Casterbridge*.

(d) Analyse the psychological complexities in the character of Heathcliff in *Emiley Brontë's Wuthering Heights*.

(e) Write with close reference to the text on Mark Twain's use of humor and pathos in *The Adventure of Huckleberry Finn*.

2021

ENGLISH

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

1. Critically evaluate the following Poem: 50

And it grows, the vain
Summer,
even for us with our
bright green sins:

behold the dry
wind,
as it stirs up quarrels
among magnolia boughs

and plays its serene
tune on
the prows of all the leaves-
and then is gone,

leaving the leaves
still there,
the tree still green, but breaking
the heart of the air.

2. Answer *any one* of the following: 50

(a) Explain how Yeats explores his thoughts and musings on immortality, art and life in "Sailing to Byzantium". Justify your answer with close textual references.

(b) Do you think that Eliot's "The Love Song of J. Alfred Prufrock" is a modernist poem? Justify your answer with references from the text.

(c) How would you explain Kamala Das's "An Introduction" as a feminist poem? Answer with proper textual references.

(d) How would you justify Auden's contention that "once an artist creates his art, the art develops its own autonomy and life and is not limited by the artist or his intentions"? Answer with references to his Poem "In Memory of W.B. Yeats".

3. Answer *any one* of the following: 50

(a) How is the theme of change represented in Yeats's "Easter 1916"? What is the "Terrible beauty" referred to here? Answer with close textual references.

(b) How is the notion of the angry young man skillfully depicted in Osborne's portrayal of the protagonist in the play *Look Back in Anger*?

(c) In what ways is the play *Waiting for Godot* relevant in our time? In what sense is the word 'waiting' significant? Justify your answer.

(d) Do you think that Sylvia Plath in "Nick and the Candlestick" has successfully depicted the creation of life and the masterful merging of metaphor and reality? Give a reasoned answer with references from the text.

4. Answer *any one* of the following: 50

(a) Show how the problem of untouchability, poverty, sexual exploitation and caste-society is depicted skillfully in the context of the novel *Kanthapura*. Answer critically.

(b) Show how Amitav Ghosh's novel *The Shadow Lines* deals with the issues of partition, identity, freedom and cross-cultural interactions in the backdrop of communal violence. Give a detailed answer.

(c) The conflict in Chinua Achebe's novel *Things Fall Apart* centres on the cultural clashes that emerge as traditional Igbo society is slowly transformed by the colonizing British administrators and missionaries. How would you justify the theme of the text? Give a reasoned answer.

(d) In what ways is Virginia Woolf's *A Room Of One's Own* a feminist critical Text focusing on the theme of freedom and confinement of women in a patriarchal society? Answer critically.

2021

COMPUTER SCIENCE

PAPER-I

Time Allowed—3 Hours *Full Marks—200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.
Answer may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer any five *questions.*

1. (a) How is the efficiency of an algorithm measured? Differentiate between lower bound and upper bound with examples. 4+6=10

   (b) Describe the quick sort algorithm and sort the following elements using it: 10

   26, 18, 42, 14, 36, 64, 6, 58, 17, 65, 82, 12

   (c) Explain divide-and-conquer algorithm with a suitable example. 10

   (d) State and explain the Dijkstra's shortest path algorithm with examples. Also find the time complexity of this algorithm. 10

2. (a) Distinguish between a linear and non-linear data structure. What is Doubly Linked List? Write an algorithm to insert and delete a node from a Doubly Linked List. 3+2+5=10

   (b) Write an algorithm for evaluating of postfix expression and show the contents of stack for the following postfix expression: 5+3=8

   6 2 3 + – 3 8 2 / + * 2 + 3 +

   (c) What is Queue? Why is it known as FIFO? Write an algorithm to insert and delete an element from a simple Queue. 2+1+5=8

   (d) Construct a tree for the given inorder and postorder traversals: 6

   Inorder: DGBAHEICF Postorder: GDBHIEFCA

   (e) Explain Breadth First Search traversal of Graph using an example. 8

3. (a) Convert the $(2A8)_{16}$ hexa decimal into decimal equivalent. What is the 2's complement of $(11001010)_2$? 5

(b) Explain the operation of a full subtractor with necessary diagrams. What is the difference between half and full subtractor? 5+2=7

(c) Find a minimal SOP representation for

$f(A,B,C,D,E) = \sum m\,(1,4,6,10,20,22,24,26) + d\,(0,11,16,27)$ using K-map method. Draw the circuit of the minimal expression using only NAND. 6+4=10

(d) What is the difference between multiplexer and demultiplexer? Explain the operation of a 8 to 1 multiplexer. 5+3=8

(e) Design a counter with the following binary sequence:

0,4,2,1,6 and repeat using JK flip-flops. 10

4. (a) Apply Gauss elimination method to solve the equations: 5

$x + 4y - z = -5;\ x + y - 6z = -12;\ 3x - y - z = 4$

(b) From the following table, estimate the number of students who obtained marks between 40 and 45. 5

Marks:	30-40	40-50	50-60	60-70	70-80
No. of students:	31	42	51	35	31

(c) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's 1/3rd rule. 6

(d) Determine $f(x)$ as a polynomial in x for the following data: 10

x :	−4	−1	0	2	5
$f(x)$:	1245	33	5	9	1335

(e) Calculate correlation coefficient r from the following data: 8

□ :	40	44	42	43	44	45
□ :	56	54	60	64	62	58

(f) The velocity V (km/min) of a moped which starts from rest, is given at fixed intervals of time t (min) as follows:

t :	2	4	6	8	10	12	14	16	18	20
V :	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes. 6

5. (a) In a full wave rectifier, the input is from 30-0-30V transformer. The load and diode forward resistances are 100Ω and 10Ω respectively. Calculate the average voltage, dc output power, ac input power, rectification efficiency and percentage regulation. 2+2+2+3+3=12

   (b) With a neat circuit diagram, explain the Voltage Divider Bias circuit by giving its exact analysis. 8

   (c) Explain the characteristics of an Ideal Op-Amp. Mention some of the applications of Op-Amp. 4+1=5

   (d) Explain how Op-Amp can be used as (i) Integrator (ii) Inverting Summer and (iii) Voltage follower. 4+3+3=10

   (e) What is a Transducer? Distinguish between active and passive transducers. 3+2=5

6. (a) Explain the different types of transmission modes. 6

   (b) What is Nyquist signalling rate for noiseless channel? 4

   (c) What is Shannon capacity for Noisy Channel? 5

   (d) Explain ASK, FSK and PSK. 10

   (e) What is an error in data communication? Explain the various types of errors that are commonly affects data communication. 2+8=10

   (f) Explain the concept of ALOHA. 5

7. (a) Define Feasible and Infeasible solution. 5

   (b) What is the difference between Assignment Problem and Transportation Problem? 5

   (c) Write the steps for solving an Assignment Problem by Hungarian method. 10

   (d) A department has five employees with five jobs to be performed. The time (in hours) each man will take to perform each job is given in the effectiveness matrix. How should the jobs be allocated one per employee, so as to minimize the total man-hours? 10

jobs	1	2	3	4	5
a	10	5	13	15	16
b	3	9	18	13	6
c	10	7	2	2	2
d	7	11	9	7	12
e	7	9	10	4	12

(e) An automobile dealer wishes to put four repairmen to four different jobs. The repairmen have somewhat different kinds of skills and they exhibit different levels of efficiency from one job to another. The dealer has estimated the number of man-hours that would be required for each job-man combination. This is given in the matrix form. Find the optimum assignment that will result in minimum man-hours needed. 10

	A	B	C	D
1	5	3	2	8
2	7	9	2	6
3	6	4	5	7
4	5	7	7	8

8. Write short notes on *any four*: 10×4=40

(a) Maximum Clique Finding Problem

(b) Poles and Zeros of a System

(c) Programmable Logic Array

(d) Multiple Access Techniques in Data Communication

(e) Infix to postfix conversion

(f) Hashing techniques

2021

COMPUTER SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer any five *questions.*

1. (a) What is operator overloading? How does the compiler interpret the operator overloading functions? What is the difference between the functions that overload the increment operator in prefix and in postfix format? Give example. 10

   (b) What is the use of class template? Create a function template for the bubble sort algorithm. 2+4=6

   (c) Explain the following terms with suitable example in respect to object oriented programming: 3+3=6

      (i) Data encapsulation

      (ii) Late binding

   (d) Explain the advantages of fibre optics over other modes of communication. If a binary signal is sent over a 3 kHz channel whose signal to noise ratio is 20 dB, what is the maximum achievable data rate? 4+4=8

   (e) Explain the different persistent methods of CSMA. 10

2. (a) What is the need of indexing? Differentiate between primary indexing and secondary indexing. How is hashing different from indexing? 3+4+3=10

   (b) What is normalization? Explain first, second and third normal form using proper example. 2+(4×2)=10

   (c) Write a program with comment to evaluate the following arithmetic statement: 5×2=10

      (i) Using a general register computer with two address instructions.

      (ii) Using an accumulator type computer with one address instructions.

   (d) Explain Prototype model. 10

3. (a) Define the term Quality Assurance. Discuss its importance in system design. 10

(b) Consider a photocopy shop that follows SJF scheduling. Suppose, the shop owner takes 2min to photocopy a page. Information about five consumers who visit the shop on a particular day is given below:

Customer	Arrival time	Number of pages
C1	10:00 AM	5
C2	10:02 AM	1
C3	10:10 AM	10
C4	10:15 AM	2
C5	10:20 AM	6

Calculate their average turnaround time and average waiting time if the scheduling algorithm is (i) non-preemptive and (ii) preemptive. 10

(c) Describe a runtime address translation scheme with proper example. 10

(d) Consider a segmentation based system. At some point in the system operation, the main memory has the following holes and in this order: 21K, 5K, 90K, 54K, 10K, 25K, 56K; there are three new requests for memory of sizes: 10K, 7K and 22K. The system follows FCFS service for memory allocation requests. Explain which holes will be taken for First fit, Worst fit and Best fit memory allocation scheme. 10

4. (a) Draw the timing diagram of the instruction LDA 9000H for 8085 microprocessor. 16

(b) Design an up-down counter to count 0 to 9 and 9 to 0 continuously with a 1·5 second delay (frequency 2MHz) between each count and display the count at one of the output ports. Show the delay calculation. 10

(c) Describe Sutherland-Cohen algorithm. Find the visible portion of the line joining two points P1(–307,631) and P2(820,–136). Given clipping window A(0,0), B(1023,0), C(1023,1023), D(0,1023), apply mid-point subdivision algorithm to find clipped portion within the window. 14

5. (a) Define the term "Multimedia Interface Design". Write at least 7 rules that need to be followed in the design of computer based instructions. 16

(b) Worker (worker id: integer, first_name: string, last_name: string, salary: integer, join_date: string, department: string)

Bonus (worker_ref_id: integer, bonus_date: string, bonus_amount: integer)

Title (worker_ref_id: integer, worker_title: string, affected_form: string)

Based on the above relation schemas answer the following questions: 24

(i) Write an SQL query to print the first three characters of First_Name from worker table.

(ii) Write an SQL query to print all worker details from the worker table order by First_Name ascending and Department descending.

(iii) Write an SQL query to fetch worker names with salaries>=50000 and<=100000.

(iv) Write an SQL query to print details of the workers who have joined in Feb, 2014.

(v) Write an SQL query to print details of the workers whose salary lies between 100000 and 500000.

(vi) Write an SQL query to print details of the workers who are also managers.

6. (a) Explain ambiguous grammer G : E → E + E | E * E | (E) | –E | id for the sentence id+id*id. 10

(b) Construct SLR parsing table for the following grammer: G : E → E + T | TT | → T * F | FF → (E) | id. 15

(c) Explain each step of compilation using proper example. 15

7. (a) Explain in detail various error detection and correction codes with examples. 10

(b) Explain Booth's algorithm for multiplying binary integer in signed 2's complement representation. 15

(c) Explain various types of addressing modes. 15

8. Write short notes on *any four* of the following: 10×4=40

(i) RSA algorithm

(ii) Three level architecture of DBMS

(iii) Shared-Memory Multiprocessor Architecture

(iv) JPEG compression

(v) Safety algorithm

(vi) Coupling and Cohesion

2021
PERSIAN
PAPER-II

Time Allowed—3 Hours *Full Marks—200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.
The figures in the margin indicate marks for each question.
Answer may be given either in ***English*** *or in* ***Persian*** *unless otherwise mentioned in the question.*

Answer *any six* questions including Question No. 7 and 8 which are compulsory:

1. Give an account of the patronage which the Persian literature received from Sultan Mahmud of Ghazna. 25

2. Trace the origin and growth of mystic poetry in Persian upto Il-Khani period. 25

3. Which Persian poet is considered as 'The poet of The East discovered by the West' and why? Illustrate your answer with reference to his reputation as a poet of world fame. 25

4. Discuss some of the important themes of the poetry of Khwja Hafiz of Shiraz and illustrate them with quotations from his Diwan. 25

5. "Modern Persian poetry reflects the social and political condition of Iran." Discuss. 25

6. Discuss the progress of Persian literature in the court of Shahjahan. 25

7. Explain *any four* of the following: 10×4=40

(الف) کار پاکان را قیاس از خود مسگیر
گرچه ماند در نبشتن شیر و شیر

(ب) توانا بود هرکه دانا بود
ز دانش دلِ پیر برنا بود

(ج) شکر شکن شوند همه طوطیان هند
زین قند پارسی که به بنگاله میرود

(د) شاعر باید که سلیم الفطرة و عظیم الفکرة و صحیح الطبع وجید الروية باشد ودقیق النظر که از انواع علوم متنوع باشد و در اطراف مستطرف. زیراکه چنانکه شعر در هر علمی بکارآید، هر علمی نیز در شعر بکار آید

(ه) قصیده کار هوس پیشگان بود عرفی
تو از قبیلهٔ عشقی وظیفه ات غزلست

8. Write notes in Persian on *any four* of the following: 15×4=60

نظامی گنجوی - منطق الطیر - سیاست نامه - تحفه العراقین
امام غزالی - صائب تبریزی - پور داؤد - ابوالقاسم لاهوتی -
محمد اقبال -

2021
PERSIAN
PAPER-I

Time Allowed—3 Hours *Full Marks—200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.
Answer may be given either in ***English*** *or* ***Persian*** *unless otherwise mentioned in the question.*

Group—A

Attempt *any two* of the following questions: 25×2=50

1. Give an account of the origin and development of Pahlavi Language. 25

2. Describe the difference between Dialect and Language. 25

3. Write notes on the following: 8+8+9

   (a) Semitic language

   (b) The Middle language

   (c) The Gatha and Huzwarish

Group—B

Attempt *any four* of the following questions: 10×4=40

4. Give the opposite number of *any five* of the following:

غنی - جسم - قبور - تیامیٰ - دنا شیر - نور - بیت

5. Explain the formation of *any five* of the following:

آفتاب - رومال - شمعدان - ارجمند - بندوبست - بوستان - خزانچی - آئینه

6. Give the uses of ج or ب.

7. Form words with *any five* of the following:

سار -بان -نار - مند - کار - ناك -ستان

8. Explain with example *any two* of the following:

صفت نسبتی -حاصل مصدر -اسم ظرف - ماضی شکیه

Group–C

9. Translate the follwing passage into English: 30

اگر خواهی که خود را بشناسی ، بدانکه ترا آفریده انداز دو چیز: یکی این کا لبدِ ظاهر که آن را تن گونید، که اان را بچشم ظاهر توان دید؛ و یکی معنی با طن که آن را نفس گونید، و دل گونید، و جان گونید، و آن را بصیرتِ با طن توان شناخت ، و بچشم ظاهر نتوان دید: و حقیقتِ تو آن معنی با طن است؛ و هر چه جزآن است، همه تبع وبست، و لشکر و خدمتگار روليست و ما آن را نام دل خواهیم نهاد، و چون حدیث دل کنیم، بدانکه آن حقیقت آری را همی خواهیم ، که گاه آن را روح گونید، و گاه نفس ، وبدین دل نه آن گوشت پاره میخواهیم ، که درسینه نهاد است، از جانب چب ، که اان را قدری بنا شد، که ان را ستوران و مرده رانیز باشد.

10. Translate the following into Persian : 30

Sant Kabir (1440-1517) hailed from Manikpur. At Jaunpur, he fell under the spell of a great Sufi Shaikh Taliq, who molded his thought forever. At Jhusi too he came in contact with Muslim religious divines. Jhusi had 21 pirs who read the Khutba (public address during the Friday congregational prayers) in the name of Allah not

the contemporary ruler as was the tradition. He was a Jolaha (weaver). He was a contemporary of Sikandar Lodi (1488-1517). The Delhi Sultanate temporarily asked Kabir to leave station to spare him (Kabir) the wrath of orthodox Hindus and Muslims.

Kabir was a genius of different order. He was a free thinker and a humanist who admired Islam's caste-less Society. Throughout his life he fought against caste inequality and narrow prejudices. He abhourred hollow rituals. His was the poetry of Bhakti. Love of one God. He was a great mystic who bore the stamp of Islamic Sufism.

11. Define *any three* of the following and give suitable examples. 10×3=30

کنایه - تلمیح - غلو - خشوزاید - مراۃ النظیر - تشبیه

12. Scan any two of the following verses and name the meter. 10×2=20

(الف) مرا در منزل جانان چه امن و عیش چون هر دم
جرس فریاد میدارد که بر بندید محملها

(ب) بشنوازنئ چون حکایت می کند
از جدای ها شکایت می کند

(ج) توانا لود هر که دانا بود.
زدانش دلِ پیر برنا بود

2021

MECHANICAL ENGINEERING

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Any data if needed may be assumed, but it must be clearly mentioned.

Answer *any five* questions.

1. (a) A vertical gate supports water on one side to a depth of 7·2 meters. Horizontal load on the gate is taken by three beams placed parallel to the water surface. Determine the position of the beams such that each beam carries one-third of the total load. 20

   (b) Water flows out through an opening, 20 cm in diameter, in the bottom of a constant level tank. Obtain an equation for the profile of the jet expressing 'V' in term of Z/H when the radius of the jet is 'V' at a depth 'Z' below the tank bottom and 'H' is the depth of water in the tank. 20

2. (a) A constant speed test of a centrifugal pump resulted in the following relationship:

   $$H = 43{\cdot}8 + 251Q - 3760Q^2$$

   where, H is the total head in metre and Q the discharge in m^3/s.

   The pump is to be used to deliver water through a pipeline 1 km long and 35 cm diameter, the static lift being 25·8 m. Calculate the operating head and the pump discharge taking the friction factor as 0·03 and neglecting the velocity heads. For the particular H vs. Q point at which the pump operates, determine the power required to drive the pump if the overall efficiency is 72%. 25

   (b) Oil of specific gravity 0·85 issues from a 5 cm diameter orifice under a pressure of 1·2 kg/cm^2 (gauge). The diameter of the jet at the vena contracta is 4·0 cm and the discharge is 1·2 m^3/ minute. What is the coefficient of velocity? 15

3. (a) Air at 227°C and 800 kPa expands to 200 kPa in a quasi-equilibrium process following the law $PV^{1\cdot3} = C$, where C is a constant. Determine the work done and heat transfer per kg of air. Specific heats of air are given as $C_P = 1{\cdot}0$ kJ/kg-K and $C_v = 0{\cdot}714$ kJ/kg-K. 15

(b) Two reversible heat engines are arranged in series in such a way that the heat rejected by the first engine is absorbed by the second engine. The first engine receives 400 kJ of heat from a reservoir maintained at temperature 600°C while the second engine rejects heat to a reservoir having temperature 0°C. If the work output of the first engine is twice that of the second, determine

(i) efficiency of both the engines,

(ii) heat rejected by the second engine,

(iii) intermediate temperature. 25

4. (a) Calculate the entropy change of 1kg of water at 27°C, when it is converted to ice at – 20°C. Specific heat of ice and water are 2·18 kJ/kg-K and 4·18 kJ/kg-K respectively. The latent heat of fusion of ice at 0°C is 335 kJ/kg. 15

(b) Two bodies, each of equal mass 'm' and heat capacity 'C_p' are at temperatures T_1 and T_2 respectively ($T_1 > T_2$). The first body is used as a source of heat for reversible engine and the second body as the sink. Show that the maximum work obtainable from such an arrangement is $mC_p \left(\sqrt{T_1} - \sqrt{T_2}\right)^2$. 25

5. (a) For the same maximum pressure and temperature of the cycle and the same heat rejection, which cycle is more efficient—Otto or Diesel? Explain with the help of P–V and T–S diagram. 20

(b) In an air standard Diesel Cycle, the pressure and temperature at the intake are 100 kPa and 27°C respectively. The maximum pressure in the cycle is 4 MPa and heat supplied during the cycle is 1000 kJ/kg. Determine

(i) the compression ratio,

(ii) the temperature at the end of the compression,

(iii) the temperature at the end of combustion,

(iv) the cut-off ratio,

(v) the air standard efficiency.

Assume : $\gamma = 1{\cdot}4$ and $C_p = 1{\cdot}005$ kJ/kg-K for air. 20

6. (a) Draw the nature of P–V and T–S plots for a Rankine Cycle with saturated steam at turbine inlet.

Why is a Carnot Cycle not practicable for a steam power plant? 10

(b) A steam power plant is designed to operate on Rankine Cycle. Steam enters into the turbine at 2 MPa, 400°C and leaves as saturated liquid in the condenser at 10 kPa. The mass flow rate of steam is 1 kg/s. Find out the power developed by the turbine and the efficiency of the cycle. Assume the efficiencies of the turbine and the pump as 0·85 and 0·8 respectively. 30

2021

HINDI

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining once ignored.

The figures in the margin indicate marks for each question.

Group-A

1. 'भाषा की परिभाषा' पर विचार करते हुए उसके मूल तत्वों को रेखांकित कीजिए। 25

अथवा,

'भाषा संप्रेषण' से क्या तात्पर्य है? उसके मूल तत्वों पर रोशनी डालिए।

2. हिंदी भाषा के विकास की संक्षिप्त रूप-रेखा प्रस्तुत कीजिए। 25

अथवा,

पश्चिमी हिंदी तथा पूर्वी हिंदी में तात्विक अंतर स्पष्ट कीजिए।

Group-B

3. आदिकाल के नामकरण एवं काल-निर्धारण की समस्या पर प्रकाश डालिए। 40

अथवा,

भक्ति-आंदोलन के उदय के कारणों पर विभिन्न विद्वानों के मतों की समीक्षा कीजिए।

4. कबीर के समाज सुधारक रूप की उदाहरण सहित विवेचना कीजिए। 40

अथवा,

'रीतिबद्ध' एवं 'रीतिमुक्त' का अंतर बताते हुए घनानंद की काव्यगत विशेषताओं की चर्चा कीजिए।

5. नवजागरण और राष्ट्रीय आंदोलन के परिप्रेक्ष्य में भारतेन्दु हरिश्चन्द्र की काव्यगत विशेषताओं का उल्लेख कीजिए। 40

अथवा,

'हिंदी निबंध' के विकास में आँचार्य रामचंद्र शुक्ल की विशिष्टताओं का मूल्यांकन कीजिए।

6. किन्हीं *दो* पर टिप्पणियाँ लिखिए: 15×2=30

(क) अमीर खुसरो

(ख) प्रगतिवाद

(ग) नाटककार जयशंकर प्रसाद

(घ) नई कहानी

2021

HINDI

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

Group-A

निम्नलिखित में से किन्हीं *तीन* प्रश्नों के उत्तर लिखिए। 40×3=120

1. तुलसीदास की 'विनय पत्रिका' के आधार पर सोदाहरण विवेचना कीजिए।

2. छायावाद को स्पष्ट करते हुए 'कामायनी आधुनिक महाकाव्य है', विवेचना कीजिए।

3. 'बहुत दिनों के बाद' एवं 'प्रेत का बयान' के आधार पर नागार्जुन की रचना-दृष्टि पर प्रकाश डालिए।

4. महादेवी वर्मा की रचनाओं में निहित नारीदृष्टि और छायावादी सौंदर्य को रेखांकित कीजिए।

5. मुक्तिबोध की रचनाओं के आधार पर सौंदर्य-चेतना का विश्लेषण कीजिए।

6. निराला की कविताओं में विद्रोह भाव है, स्पष्ट कीजिए।

Group-B

निम्नलिखित में से किन्हीं *दो* प्रश्नों के उत्तर लिखिए। 40×2=80

7. 'श्रद्धा और भक्ति' एवं 'क्रोध' निबंधों के आधार पर विवेचना कीजिए।

8. फणीश्वर नाथ रेणु की कहानियों के आधार पर आंचलिक साहित्य का विश्लेषण कीजिए।

9. 'ध्रुवस्वामिनी' के आधार पर प्रसाद की नारी विषयक दृष्टि पर प्रकाश डालिए।

10. भैरव प्रसाद गुप्त की रचना 'गंगा मैया' की समीक्षात्मक विवेचना कीजिए।

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7. (a) A refrigeration plant using CO_2 as refrigerant work between 25°C and –5°C. The dryness of CO_2 is 0·6 at the entry of the compressor. Find the ice formed per day if the ice is formed at 0°C and from the water at 10°C. Quantity of CO_2 circulated = 10 kg/min. Take relative efficiency = 0·6.

C_p (water) = 4·2 kJ/kg.

Latent heat of ice = 335 kJ/kg.

Take following properties of CO_2:

Temperature °C	Liquid heat kJ/kg	Latent heat kJ/kg	Entropy of liquid kJ/kg-K
25	81·25	121·6	0·2513
– 5	– 7·53	245·8	– 0·0419

Determine the C.O.P. of the system. 20

(b) A furnace wall is made of 20 cm of magnesite brick and 20 cm of common brick. The magnesite brick is exposed to hot gases at 1355°C and common brick outer surface is exposed to air at 45°C. The convection and radiation heat transfer coefficients towards gas side are 16·5 and 17·5 W/m^2-°C respectively. The convection and radiation heat transfer coefficients towards outside are 12·5 and 6·5 W/m^2-°C respectively. Thermal conductivities of magnesite and common bricks are 4 and 0·65W/m^2-°C respectively. 20

Determine

(i) Heat loss per m^2 area of the furnace wall

(ii) Maximum temperature to which common brick is subjected.

2021

ZOOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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*Answer may be given either in **English** or in **Bengali** but all answer must be in one and same language.*

Group-A

1. Answer *any ten* questions: 4×10=40

   (a) What do you mean by marsipobranch animal?

   (b) Classify Phylum Porifera up to subclass.

   (c) What are chloragogen cell and its function?

   (d) State the occurrence and function of Tiedemann's body.

   (e) What is the difference between ophisthoglyphous and solenglyphous types of teeth?

   (f) Define Biological Hot Spot with example.

   (g) What is resource partitioning?

   (h) Define altruism with suitable example.

   (i) Mention the importance and significance of honeybee dance.

   (j) Mention the difference between Hatschek nephridia and Septal nephridia.

   (k) What are Diploe and Melon? Mention their significance.

   (l) Name a poisonous mammal with comment.

Group-B

Answer *any four* questions.

2. Write concise notes on any three of the following in about 200 words each: 5×4=20

   (a) Symmetry in non-chordates

   (b) Life history of *Obelia*

   (c) General features of Monotremata

   (d) Digital tips in vertebrates

3. (a) Describe Torsion and Detorsion in Mollusca. 10+10=20

   (b) What is metamerism? Describe its importance in Invertebrate evolution.

4. Write brief notes on the following: 6+7+7=20

   (a) Migration of Fish

   (b) Social behaviour of *Apis*

   (c) Parental care in Amphibia

5. Why Onychophorans are considered as Living Fossils? What do you mean by Minor Phyla? Mention the systematic position and affinities of *Balanglossus*. Comment on the ciliary mode of feeding in Cephalochordates. 4+3+5+8=20

6. Write short notes: 5×4=20

   (a) Development of scale in Fish/Neuromast organ in fish

   (b) Structure of atypical feather in bird

   (c) Echolocation in Bat

   (d) Structure of gill in elasmobranch and bony fish

7. Distinguish between: 5×4=20

   (a) Ommatidia and Ocelli

   (b) Ephyra and Scyphistoma

   (c) Filopodia and Reticulopodia

   (d) Porocyte and Choanocyte

8. Write short notes: 4×5=20

   (a) Foraminiferan Ooze

   (b) Darwin Dana Subsidence theory

   (c) Arrhenotoky

   (d) Leuconoid canal system

   (e) Genes involved in Polymorphism in Siphonophora

Group-C

Answer *any four* questions.

9. What do you mean by Biological species concept? Define Allopatric and sympatric species. Mention the factors that contribute in speciation. What are Cladistics and Phenetics? State the significance of Biopiracy. 4+4+4+4+4=20

10. (a) Explain K-T mass extinction and its biological consequences.

    (b) With suitable example, discuss adaptive radiation in the Finches in Galapagos Island.

    (c) Outline man-ape differences. What advantages could bipedalism have offered to early hominids? 5+7+8=20

11. Distinguish between: 5×4=20

    (a) Hydrosere and Xerosere

    (b) Antibiosis and Symbiosis

    (c) Ecotone and Edge effect

    (d) Eutrophy and Dystrophy

12. Comment on the following: 5×4=20

    (a) Species dominance in community

    (b) Sympatric isolating mechanism operative before and after fertilisation

    (c) Interspecific competition in natural communities

    (d) Trends towards increasing efficiency of energy and nutrient utilization during autogenic succession

13. State Hutchinson's proposition of niche concept. Explain the term Guild and Ecological equivalence with example. What do you mean by holotype, syntype, lectotype and neotype? 5+7+8=20

14. Point out the clues involved during parental investment in fish. Why β diversity is regarded as a vector entity? State the main anthropogenic sources of important greenhouse gases. Distinguish between Bioaccumulation and Biomagnification. What is umbrella species? 7+3+4+4+2=20

2021

ZOOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answer may be given either in **English** or in **Bengali** but all answer must be in one and same language.*

Group-A

Answer *any ten* questions. 4×10=40

1. (a) Delineate the salient features of the fluid-mosaic model of plasma membrane structure.
   (b) Explain why lysosomes are called polymorphic cell organelles.
   (c) What are check points in cell cycle? What happens at each check point during the cell cycle?
   (d) Mention the characteristic features of autosomal recessive inheritance pattern in human with the help of a pedigree.
   (e) The father of two children is of blood type O and the mother is type A. The children are O and A. Given this information, what can you say about the genotypes of father and mother?
   (f) Define 'missense mutation' and briefly elaborate the involvement of such mutation in the development of sickle cell anaemia.
   (g) Distinguish between protooncogene, oncogene and tumour suppressor gene.
   (h) Briefly discuss the histological features of mammalian ovary.
   (i) Elaborate the concept of Michaelis – Menten constant (K_M) of an enzyme.
   (j) Write in brief about secondary structures of proteins.
   (k) State the similarities and dissimilarities between mammalian fauna of Oriental and Ethiopian realm.
   (l) What is meant by integrated fish culture and what are its advantages?
   (m) Draw and briefly describe the basic structure of an immunoglobulin molecule.

Group-B

Answer *any four* questions.

2. Distinguish between: 5×4=20
   (a) RER and SER
   (b) DNA polymerase and RNA polymerase

(c) Diabetes mellitus and Diabetes insipidus

(d) RAPD and RFLP

3. Write notes on the following: 5×4=20

(a) Electron transport chain

(b) Types of chemical mutagens

(c) Second messenger in signal transduction

(d) Synaptic transmission

4. (a) Discuss briefly how proteins are synthesized, modified and secreted through the GERL system.

(b) Compare and contrast euchromatin and heterochromatin.

(c) What happens during the S phase of the cell cycle? 10+6+4=20

5. (a) DNA replication is a semi-discontinuous process – explain.

(b) Distinguish between rho (ρ) – dependent and rho (ρ) – independent mechanisms of termination of transcription in *E. coli.*

(c) List the major post transcriptional modifications of eukaryotic pre-mRNA before it leave the nucleus. 8+8+4=20

6. (a) Compare and contrast the mechanism of action of peptide and steroid hormones with examples.

(b) Write in brief about the mechanism of hormonal control of insect metamorphosis.

(c) Mention the functions of Sertoli cells. 8+8+4=20

7. (a) Classify enzymes based on the reactions they catalyse. Give examples of each class.

(b) Briefly explain the mechanism of propagation of an action potential through myelinated nerve fibre.

(c) How does a spectrophotometer work? 8+8+4=20

Group-C

Answer *any four* questions.

8. Distinguish between: 5×4=20

(a) Spermatogenesis and Oogenesis

(b) Acrosome reaction and Cortical reaction

(c) Cryptic and Aposematic colouration

(d) T cell and B cell

9. Write notes on the following: 5×4=20

   (a) Types of eggs based on the amount of yolk with examples

   (b) Types of placenta based on the distribution of villi with examples

   (c) Neutral theory

   (d) Induced breeding of IMC

10. (a) Explain the role of yolk in cleavage.

    (b) Compare the process of cleavage in frog and chick.

    (c) Dorsal lip of blastopore is the primary organizer of amphibian embryo – discuss. 4+8+8=20

11. (a) State the hypothesis of 'Oparin - Haldane' to explain the prebiotic condition favourable for origin of life.

    (b) Delineate the basic tenets of evolution by natural selection as defined by Darwin.

    (c) 100 persons from a small town were tested for their MN blood types. The genotypic data are: MM 41; MN 38; and NN 21. Calculate the frequency of M and N alleles. Explain whether the population is in Hardy-Weinberg equilibrium or not.

    (d) Evolution of horse was triggered by a change in the climate and vegetation during lower cenozoic period – explain. 4+4+6+6=20

12. (a) What is a deep litter system for poultry farming? Mention the advantages of the system.

    (b) Write the scientific name of jute stem weevil. Mention the damage symptoms of the pest.

    (c) Comment on the advantages and disadvantages of IPM.

    (d) Write the scientific name of a mammalian pest and mention the extent of damage caused by it. 5+5+5+5=20

13. (a) Describe the life cycle of *Wuchereria bancrofti.* Add a note on its pathogenicity.

    (b) Classify immunoglobulin based on the following parameters: structure, number of antigen binding sites, H-chain type, distribution and function.

    (c) Add a note on retrovirus. (5+5)+6+4=20

2021

PHYSIOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) What is pH? Mention the physiological importance of buffers in human blood.
   (b) State the biological applications of osmosis.
   (c) State the importance of "alkali reserve" in plasma.
   (d) State in brief about osmotic work. 10+10+10+10=40

2. (a) Explain why a disaccharide like 'lactose' exhibits reducing property, where as sucrose does not.
   (b) Write short notes on stereoisomerism and anomerism.
   (c) Write the systemic name and structure of histidine and valine.
   (d) Write the reaction of monosaccharides with concentrated mineral acids and excess phenylhydrazine.
   (e) What information you could get from the titration curve of glycine? 6+(5+5)+(3+3)+(5+5)+8=40

3. (a) State about the different reaction mechanisms of deamination of amino acids.
   (b) What is R–L cycle? State its significance.
   (c) Write the sources of NADPH and acetyl-coA for lipogenesis.
   (d) How can different hexose sugars enter the pathway of glycolysis? 10+10+(5+5)+10=40

4. (a) Discuss the biological functions and deficiency symptoms of calcium in our body.
   (b) What do you mean by hypervitaminosis D? State the functions of vitamin K in blood coagulation and carboxylations.
   (c) State briefly the principles of formulation of balanced diet for lactating woman.
   (d) What are fundamental foods?
   (e) Discuss the functions of vitamin A in glycoprotein synthesis and growth promotion. 10+(3+7)+10+(3+7)=40

5. (a) Why haem is tagged with globin? Describe the fate of haemoglobin in our body.
   (b) Why secondary immune response onsets faster than primary immune response?
   (c) State any four requirements of a molecule for being an immunogen.
   (d) Describe the physiological basis of ABO blood group system.
   (e) Describe plasmapheresis with its significance. (3+7)+10+10+10=40

Group-B

Answer *any two* questions.

6. (a) Graphically show the pressure changes in the atria during different phases of cardiac cycle and explain.
   (b) Briefly describe the origin and significance of ECG waves.
   (c) Discuss in brief about different types of electrocardiographic leads used to record ECG.
   (d) State Starling's Law of heart.
   (e) Name two types of cell junctions found at the intercalated disc. Mention their functions. 10+10+10+4+(2+4)=40

7. (a) What is cardiac output? Discuss the factors affecting it.
   (b) Discuss in brief about "Stannius ligature" and "Overdrive suppression".
   (c) Elucidate the process of origin and spread of cardiac impulse.
   (d) Describe the Fick's principle of cardiac output measurement. (2+8)+(5+5)+10+10=40

8. (a) Describe the effects of temperature, pH, pCO_2 and 2-3 BPG on the dynamics of oxyhaemoglobin dissociation curve.
   (b) What is hypoxia? Elaborate different types of hypoxia.
   (c) How is Functional Residual Capacity (FRC) of an individual determined?
   (d) What is spirometry? What is the significance of alveolar surfactant? Mention its source and composition. 10+(2+8)+10+(3+3+1+3)=40

9. (a) Describe the forces involved in the process of glomerular filtration.
   (b) Briefly describe the non-excretory functions of Kidney.
   (c) Describe the effect of the deficiency of ADH in the formation of urine.
   (d) Discuss the role of kidney in the regulation of acid-base balance of the body fluids. 10+10+10+10=40

2021

PHYSIOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the same language.*

Group-A

Answer *any three* questions.

1. (a) Draw and describe the ultrastructure of a nerve-muscle junction.
   (b) Describe the molecular mechanism of synaptic transmission.
   (c) Discuss the structure and function of acetylcholine receptor found in skeletal muscle.
   (d) Discuss the origin, course, termination and functions of the tract of Goll and Burdach. 10+10+10+10=40

2. (a) Name the hypothalamic nuclei. Discuss the role of hypothalamus in regulating food intake and thrist.
   (b) Name the different types of GABA receptors and discuss their functions.
   (c) Discuss the excitation-contraction coupling in skeletal muscles.
   (d) Discuss the roles of different nerve fibres in pain perception. 10+10+10+10=40

3. (a) Describe the ionic basis of resting and excitable state of membrane potential.
   (b) Describe briefly the histological structure and functions of cerebellum.
   (c) Discuss the physiological basis of learning and memory.
   (d) Discuss the functions of autonomic nervous system and its control. 10+10+10+10=40

4. (a) Draw and describe the structure of cochlea.
   (b) Discuss the origin, course and termination of auditory pathway.
   (c) Discuss the sensory neural pathway of olfaction.
   (d) Discuss the visual pathway and mention the effects of lesion of the pathway at lateral geniculate body. 10+10+10+10=40

5. (a) 'Receptors are biological transducers.'— Discuss why?
   (b) Define and explain (i) Bell-Magendie law, (ii) Weber-Flechner law.
   (c) Compare the effects of (i) complete and (ii) incomplete transection of spinal cord.
   (d) Discuss the nerve pathway of taste sensation. 10+10+10+10=40

6. (a) Discuss the processes for maintenance of human body temperature.
   (b) Discuss the physiological changes occur in exposure to extreme hot and cold climate.
   (c) Discuss the structure of skin with a neat diagram.
   (d) Write the composition of sweat and discuss the mechanism of sweat secretion.
   10+10+10+10=40

Group-B

Answer *any two* questions.

7. (a) Discuss the structure and functions of parathormone.
   (b) Discuss the synthesis, storage and release of insulin.
   (c) Name the active principles of adrenal gland and state their functions.
   (d) Compare the structure and functions of estrogen and progesterone. 10+10+10+10=40

8. (a) Discuss the role of hormones in pregnancy.
   (b) Discuss the actions of progesterone on uterus and ovary.
   (c) Discuss the peculiarities of foetal circulation.
   (d) Discuss the role of hormones in breast development and on lactation. 10+10+10+10=40

9. (a) Discuss the ground water laced arsenic control program adopted in India.
   (b) Discuss the goiter and anemia control program implemented by Govt. of India.
   (c) Discuss the strategies that may control misuse of pesticide in agriculture.
   (d) What is climate change? Discuss the effects of sound pollution on human body.
   10+10+10+(4+6)=40

10. (a) Discuss the assessment of pulmonary volumes and capacities by a spirometer.
    (b) Write notes on (i) Vital capacity, (ii) Dead space.
    (c) Discuss the principle, procedure and applications of Harvard step test method.
    (d) Write notes on: (i) Body mass index, (ii) Anthropometric measurement.
    10+(5+5)+10+10=40

2021

SANSKRIT

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be written either in **English** or in **Bengali** or in **Sanskrit** but all answer must be in one and the same language.

Group-A

1. Write critically the historical background of Indo-European family of languages showing the Phonetic tendencies of them. 30

Or,

Write a comprehensive note on the Non-Aryan Influence in Sanskrit showing the development of linguistic studies in such a language. 30

2. Define and illustrate *any two* of the following: 10×2=20
   (a) Grimm's law
   (b) Dissimilation
   (c) Subjunctive
   (d) Gerund

Group-B

3. Explain *any two* of the following rules in Sanskrit: 10×2=20
   (a) आधारोऽधिकरणम्।
   (b) उभयप्राप्तौ कर्मणि।
   (c) समर्थः पदविधिः।

4. Account for the case-ending in *any five* of the underline words by citation of relevant Pāṇini's Sūtras on each case. 4×5=20
   (a) श्वशुराज् जिद्रेति वधूः।
   (b) यागाय याति।
   (c) फलेभ्यो गच्छति।
   (d) जपमनु प्रावर्षत्।
   (e) चर्मणि द्वीपिनं हन्ति।
   (f) प्रासादात् प्रेक्षते राजा।

5. Name and expound the Samāsa or compound in *any five* of the following: 4×5=20

(a) त्रिमुनि।

(b) उन्मत्तगङ्गम्।

(c) तीर्थकाकः।

(d) पुरुषसिंहः।

(e) त्रिलोकी।

(f) अग्नीषोमौ।

6. Justify *any two* of the following in Sanskrit: 10×2=20

(a) नृसिंहाय नमस्कुर्मः।

(b) वपुषा चतुर्विधः।

(c) तुलां यदारोहति दन्तवाससा।

(d) अथोपयन्तारमलं समाधिना।

Group-C

7. Translate into either English or Bengali *any two* of the follwoing: 10×2=20

(a) चित्रं देवानामुदगादनीकं
चक्षुर्मित्रस्य वरुणस्याग्नेः।
आप्रा द्यावापृथिवी अन्तरिक्षं
सूर्य आत्मा जगतस्तस्थुषश्च।।

(b) यो हत्वाहिमरिणात् सप्त सिन्धून्
यो गा उदाजदपधा वलस्य।
यो अश्मनोरन्तरग्निं जजान
संवृक् समत्सु स जनास इन्द्रः।।

(c) स नः पितेव सूनवे-
ऽग्ने सूपायनो भव।
सचस्वा नः स्वस्तये।।

Group-D

8. Translate from English into Sanskrit: 30

Waters in Varuṇa are created by the mind of Prajāpati. Waters create in a worshipper the faith of religious performances. Varuṇa leads his progeny on the right path. In this way waters and Varuṇa serve the mind, their father. The field of enjoyment of life of a worshipper extends as far as waters and Varuṇa pervade. The field of activities of a worshipper who knows the affluence of mind as described herein, does not wither away as long as the land of pervasion of waters and Varuṇa does not perish.

Or,

Translate into English from Sanskrit:

अस्ति दाक्षिणात्ये जनपदे महिलारोप्यं नाम नगरम्। नत्र सकलार्थि कल्पद्रुमः प्रवरनृपमुकुटमणिमरीचिमञ्जरीचयचर्चितचरणयुगलः सकलकलापारङ्गतोऽमरशक्तिर्नाम राजा बभूव। तस्य त्रयः पुत्र परमदुर्मेधसो बहुशक्तिरुग्रशक्तिरनन्तशक्तिश्चेति नामानो बभुवुः।

Group-E

9. Write a paragraph in *any one* of the following topic in Sanskrit: 20

(a) संस्कृतभाषाया जातीयचारित्रिकवैशिष्ट्ये उपयोगः।

(b) कविषु कालिदासः श्रेष्ठः।

(c) कर्षणवृत्तौ नदीनां प्रयोजनम्।

2021
URDU
PAPER-I

Full Marks: 200

ime Allowed : 3 Hours

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to prescribed number shall be valued and the remaining ones ignored.

Answer should be written in ***Urdu***

Group: A

–1 قدیم ہند آریائی زبانوں سے متعلق اپنی واقفیت کا اظہار کیجیے۔ 30

یا

مغربی ہندی اور اس کی مختلف بولیوں کا جائزہ لیجیے۔

–2 دکنی زبان کی لسانی خصوصیات کا تفصیلی جائزہ لیجیے۔ 30

یا

ڈاکٹر جان گل کرسٹ کی ادبی خدمات کا جائزہ لیجیے۔

Group: B

–3 میر تقی میرؔ کی غزل گوئی کی امتیازی خصوصیات کا جائزہ لیجیے۔ 30

یا

ناصر کاظمی کو بحیثیت غزل گو پیش کیجیے۔

30

4– قصیدہ ''در تضحیکِ روزگار'' کا تنقیدی مطالعہ پیش کیجئے۔

یا

نظیر اکبرآبادی کی نظم نگاری کا تنقیدی جائزہ لیجئے۔

10×2=20

5– کسی دو پر مختصر نوٹ لکھئے:

(الف) نظم ''ایک لڑکا''

(ب) نظم ''تنہائی''

(ج) غالب کا سفر کلکتہ

30

6– دبستانِ لکھنؤ کی امتیازی خصوصیات کا جائزہ لیجئے۔

یا

اردو ادب میں ''جدیدیت'' کے رجحان کی عکاسی مع مثال کیجئے۔

5×3=15

7– درج ذیل اشعار میں سے کسی تین کی تشریح کیجئے۔

(الف) مفلسی سب بہار کھوتی ہے
مرد کا اعتبار کھوتی ہے

(ب) آفاق کی منزل سے گیا کون سلامت
اسباب لُٹا راہ میں یاں ہر سفری کا

(ج) تیرے قریب رہ کے بھی دل مطمئن نہ تھا
گزری ہے مجھ پہ یہ بھی قیامت کبھی کبھی

(د) کاوِکاوِسخت جانی ہائے تنہائی نہ پوچھ
صبح کرنا شام کا، لانا ہے جوئے شیر کا

8– درج ذیل رباعی کا مرکزی خیال واضح کیجئے . 15

اے معنیٔ کائنات مجھ میں آجا
اے رازِ صفات و ذات مجھ میں آجا
سوتا سنسار جھملاتے تارے
اب بھیگ چلی ہے رات مجھ میں آجا

6. Analyse the source and deviation of "Uttarāmācaritam" of Bhavabhūti. How many acts are found in this drama. Justify the remark "Kāruṇyaṃ Bhavabhūtireva tanute" with special reference to this drama. 18+2+20=40

7. Critically estimate the poetic excellence of Kālidāsa with special reference to his Mahākāvya, the "Kumārasambhavam". 40

8. Write a comprehensive note on the policy of taxation as revealed in Manusaṃhitā, Chapter-VII. By what name this chapter is titled by the author? 38+2=40

2021

SANSKRIT

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be written either in **English** *or in* **Bengali** *or in* **Sanskrit** *but all answer must be in one and the same language.*

Answer question no. 1 & 2 *and* any three *of the rest.*

1. What is meant by the term "Philosophical Hymns"? Mention the source of these hymns. Give an account of any four of such hymns. 6+2+32=40

Or,

Analyse the significance of the term "Upaniṣad" and mention the source of the Upaniṣads. Write a comprehensive note on the main teachings of Upaniṣad. 8+2+30=40

2. Write a comprehensive note on different Buddhist schools and analyse the philosophical doctrines of these schools. 20+20=40

Or,

Who is the author of 'Vaiśeṣika sūtra'? Analyse his theory of atomism that is revealed in Vaiśeṣika system. 2+38=40

3. Name anather title of the Rāmāyaṇa that is found in the Mahābhārata. In which Kāṇḍa of the Rāmāyaṇa the episode of Mārīca is included? Estimate the importance of this great epic in the social, cultural and religious history of India. 2+2+36=40

4. Critically analyse the characteristic features of the thirteen dramas of Bhāsa. By whom these dramas discovered and when? How did he establish his opinion related to the authorship of Bhāsa? 28+1+1+10=40

5. What is meant by the term "Aṣṭāṅga Āyurveda"? Name the eight sectors of Āyurveda. Critically estimate the value of the two famous texts Ćarakasaṃhitā and Suśrutasaṃhitā. 4+8+28=40

2021
URDU
PAPER-II

Time Allowed : 3 Hours *Full Marks: 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to prescribed number shall be valued and the remaining ones ignored.

*Answer should be written in **Urdu***

Group: A

–1 درج ذیل سوالات میں سے کسی چار کے جواب تحریر کیجئے۔ 30×4=120

(i) ''غبارِ خاطر'' کی روشنی میں مولانا ابوالکلام آزاد کی اسلوب نگاری کا تنقیدی جائزہ لیجئے۔

(ii) مختصر اردو افسانہ کے فن کی تعریف کیجئے اور اس کے اجزائے ترکیب بیان کیجئے۔

(iii) سعادت حسن منٹو کو بحیثیت افسانہ نگار پیش کیجئے۔

(iv) محمد حسین آزاد نے ''آب حیات'' لکھ کر جدید طرز کی تذکرہ نگاری کا آغاز کیا ہے۔ اس قول کی تردید یا تائید کیجئے۔

(v) مقالہ ''تہذیب'' کی روشنی میں سرسید احمد خان کی مقالہ نگاری کا جائزہ لیجئے۔

(vi) اردو ڈرامہ کے آغاز وارتقاء سے متعلق اپنی واقفیت کا اظہار کیجئے۔

(vii) ناول ''گئودان'' کا مرکزی کردار ہوری پر مفصل نوٹ لکھئے۔

(viii) ناول کے فن کی تعریف کیجئے۔ اور اس کے فنی لوازم پر تفصیلی روشنی ڈالیے۔

Group: B

2– درج ذیل سوالات میں سے کسی دو کے جواب لکھیئے : 20×2=40

(i) ''مقدمہ شعروشاعری کواردوفن تنقید کا پہلا مقدمہ قرار دیا جاتا ہے۔''
اس قول کی روشنی میں حالؔی کی تنقید نگاری کا جائزہ لیجئے۔

(ii) کلیم الدین احمد کو بحیثیت تنقید نگاری پیش کیجئے۔

(iii) شمس الرحمٰن فاروقی کی تنقیدی بصیرت کا جائزہ لیجئے۔

(iv) ''ادب اور زندگی'' کی روشنی میں مجنوں گورکھپوری کا تنقیدی نظریہ کا جائزہ لیجئے۔

Group: C

3– درج ذیل عنوانات میں سے کسی ایک پر مضمون لکھیئے : 40

(الف) مغربی بنگال میں اردو شاعری آزادی کے بعد

(ب) ۲۰ویں صدی میں بنگال کی اردو صحافت

(ج) مغربی بنگال میں اردو ڈراما

(د) نوجوانوں میں تمباکو نوشی کے چلن کے بُرے اثرات

2021

BOTANY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** or in **Nepali** but all answers must be in one and same language.*

Group-A

Answer *any four* of the following:

1. Write brief notes on *any four* of the following: 10×4=40
   (a) NPC classification by Erdtman
   (b) Role of pathotoxins in plant disease
   (c) Ecological importance of lichens
   (d) Rules of reconstruction of plant fossils
   (e) Post fertilization changes in angiosperms
   (f) One step growth curve

2. Distinguish between *any four* of the following: 10×4=40
   (a) Lytic cycle and lysogenic cycle of virus
   (b) Anatomical adaptation of hydrophyte and xerophyte
   (c) Age and area Hypothesis and Epibiotic theory of Endemism
   (d) Cell wall structure of Gram positive and Gram negative bacteria
   (e) *In situ* and *ex-situ* conservation
   (f) Indented and bracketed key

3. Explain *any four* of the following: 10×4=40
   (a) Degeneration of sex in fungi
   (b) Process of conjugation in bacteria
   (c) Sculpturing of diatom cell wall
   (d) Diagnostic features of Orchidaceae and Solanaceae
   (e) Phylogenetic significance of Progymnasperms
   (f) Role of phytoalexin in plant defence

Please Turn Over

4. Comment on *any four* of the following: 10×4=40

   (a) Heterothallism in fungi

   (b) Physicochemical characters of TMV

   (c) Aeropalynology

   (d) Types of stomata in dicotyledons

   (e) Industrial production of cheese

   (f) Role of bryophytes in Pollution monitoring

5. Discuss *any four* of the following: 10×4=40

   (a) Different types of placentation in angiosperms

   (b) Origin of seed habit

   (c) Abnormal secondary growth in *Bignonia*

   (d) Phytochemical data for solving taxonomic problem

   (e) Disease triangle

   (f) Principles of mass culture of microalgae

Group-B

Answer *any two* questions:

6. (a) Discuss the symptoms and disease cycle in 'Brown spot disease of rice'. How can the disease be controlled? 6+4=10

   (b) Discuss in brief the different modes of preservation of fossils according to Schopf. 10

7. (a) Define mechanical tissues. Discuss the principles governing the distribution of mechanical tissue in plants. 10

   (b) Discuss the fungal sources and uses of cellulose, tryptophon riboflavin and Griseofulvin. 2½×4=10

8. (a) Name the male and female fructifications of *Williamsonia sewardiana*. Describe the male and female fructification in brief. 2+8=10

   (b) Give a brief account of phytogeographical regions of India. Name five endemic plants of Eastern Himalaya. 5+5=10

2021

BOTANY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** or in **Nepali** but all answers must be in one and same language.*

Answer *any five* questions. 40×5=200

1. Answer *any four* from the following:
   (a) Answer very briefly:
      (i) Nomenclature of fatty acids
      (ii) Antibiotics inhibit 'transcription' process
      (iii) RNA editing 3+3+4=10
   (b) Distinguish between:
      (i) Homeotic gene and Caretaker gene
      (ii) T-DNA and P-Protein
      (iii) DNA zymes and DNA aptamers 3+4+3=10
   (c) Explain with diagram:
      (i) ATP synthase complex
      (ii) mRNA capping and polyadenylation
      (iii) Enumerate the structural details of plasma membrane 3+4+3=10
   (d) Describe in brief:
      (i) Cryptochrome
      (ii) Supersecondary structure of protein
      (iii) Pericentric inversion 3+4+3=10
   (e) Justify the statements:
      (i) Plasma membrane is asymmetric in structure.
      (ii) rho protein helps to terminate transcription process.
      (iii) Non-Mendelian inheritance. 3+3+4=10

2. Answer *any four* from the following:
   (a) (i) Calculate the centrifugal force at a radius of 10cm rotor spinning at 15,000 rpm. ($g = 9.81\ ms^{-2}$)
      (ii) When long chain fatty acids are oxidized to CO_2 and H_2O, the following types of reactions are encountered:
         (A) A reaction in which a carbon-sulfur bond is formed.
         (B) A reaction that involves the breaking of carbon-carbon bond.
      Indicate co-factors, enzymes in the above reactions. 4+6=10

(b) Explain with reasons:

(i) Distinguish between nullisomic and double monosomic.

(ii) Explain central dogma of molecular biology. 5+5=10

(c) Identify two major structural differences in B-form and Z-form of DNA. What is the role of topoisomerase in DNA replication? What is Linking number (Lk)? What will be the Lk in 400 base pair DNA? 3+3+3+1=10

(d) Write short notes on:

(i) Tight junction and Desmosome 2·5×2=5

(ii) Characterise different subunits of Nitrogenase complex. Mention the role of these subunits in nitrogen fixation. 2+3=5

(e) Compare the following:

(i) nif gene and nod gene

(ii) RNA polymerase of prokaryote and eukaryote

(iii) Nitrification and ammonification 3+3+4=10

3. Answer *any four* from the following:

(a) Discuss the role of phytochrome in flowering. 10

(b) Describe with diagram:

(i) Different stages of Prophase I of meiosis

(ii) Characteristics of cp DNA

(iii) What is volatile buffer? Name one volatile buffer used for protein analysis. 4+4+2=10

(c) What is photorespiration? Comment in detail on compartmentation of biochemical events in photorespiration. 2+8=10

(d) Compare between:

(i) Southern blot and Western blot

(ii) Omega 3 and omega 6 fatty acids 6+4=10

(e) Describe briefly:

(i) Role of auxin in phototropism.

(ii) Non-cyclic photophosphorylation. 5+5=10

4. Answer *any four* from the following:

(a) Explain briefly:

(i) Genetic code is Degenerative and Ambiguous.

(ii) What is km?

(iii) What is Go phase? 6+2+2=10

(b) Write a brief note on different methods of Gene transfer in plants. 10

(c) Explain briefly: 5×2=10

(i) Autopolyploid

(ii) Allopolyploid

(d) (i) Write down in flow chart the steps of glycolysis with the name of the enzymes.

(ii) What do you mean by substrate level phosphorylation and oxidative phosphorylation?

(e) (i) What is glyoxylate cycle? Describe it in flow chart.

(ii) Mention the major event of CO_2 fixation through CAM cycle. 6+4=10

5. Answer *any four* from the following: 5+5=10

(a) (i) Classify secondary metabolites according to their chemical structure and with example.

(ii) Write the systematic position of *Cinchona*, *Ipecac*, *Adhatoda* and *Curcuma*. 5+5=10

(b) Distinguish between holoenzyme, apoenzyme, coenzyme and cofactor. 10

(c) Define:

(i) What is isoelectric focusing?

(ii) Explain Fischer's and Koshland's model for substrate-enzyme complex.

(iii) What is abzyme?

(d) Enumerate: 2+6+2=10

(i) What is molar extinction coefficient?

(ii) What is the difference in application of Colorimeter and Spectrophotometer?

(iii) What is somatic hybridization?

(iv) What is the principle for ELISA operation?

(e) Explain in brief: 2+2+3+3=10

(i) Role of Jasmonic acid and Salicylic acid as primary defence signalling molecules under abiotic and biotic stress.

(ii) Fatty acid synthase of prokaryotes and eukaryotes.

6. Answer *any four* from the following: 5+5=10

(a) (i) What do you mean by 'Normal distribution'?

(ii) What do you mean by frequency class interval?

(iii) Some seeds were classified in terms of color (white and red) and in terms of shapes (round, square) to observe whether there is *any relationship between color and shapes*. Data were tabulated from 105 seeds and presented in 2 rows and 2 columns. To check null and alternative hypothesis:

(A) Seed shape is not associated with color.

(B) Shape is associated with color.

(Observed count)	Round	Square	Total
White color	36	14	50
Red color	30	25	55
Totals	66	39	105

Compute the Chi square value and justify your statement.

[*Table value for 1 degrees of freedom at 0.10 is 2.706 and 0.05 is 3.841*] 2+2+6=10

(b) (i) What is Hexose Monophosphate Shunt? What is its biological significance?

(ii) What is Phytochelatin? Give example. 6+4=10

(c) (i) Describe the role of ribosome in eukaryotic protein synthesis. 5+5=10

(ii) What is snoRNA? Mention its role in pre-rRNA processing.

(d) (i) What are the basic composition of MS media?

(ii) What are the essential fatty acids and essential amino acids? Give examples in each case. 2+3+5=10

(iii) What is Sanger's reagent? What is its role in protein sequencing? 5+5=10

(e) Role of GA in seed germination and flowering.

7. Answer *any four* from the following:

(a) Explain in brief:

(i) Sugar pucker in DNA

(ii) Base analog in mutation 4+3+3=10

(iii) DNA methylation

(b) Explain schematically the major pathways for production of secondary metabolites. 10

(i) MVA

(ii) Shikimic acid

(iii) MEP pathways

(c) (i) What do you mean by metabolic engineering?

(ii) What is glycocalyx?

(iii) In which principle does Scanning Electron Microscope work? 5+2+3=10

(d) Distinguish between crossing over, translocation and inversion (pericentric and paracentric) of chromosome. Explain with diagram. 10

(e) Briefly discuss the nucleosome model of chromosome. 10

2021

GEOLOGY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) What is a seismogram? Illustrate and explain how the epicentre of an earthquake can be located from the seismogram data. What is a seismic shadow zone? 20

   (b) Explain *any two* of the following: 10×2=20

   (i) Intensity of earthquakes

   (ii) Recording of earthquakes

   (iii) Assessment of seismic risks

2. (a) Define a fold. How folds are classified? Explain with the help of neat sketches the important types of folds, as distinguished on the basis of inclination of axial plane. 20

   (b) Describe the different types of plate boundaries and their characteristic features. How does plate tectonic theory supports the continental drift theory? 20

3. (a) What is 'Hydraulic Conductivity of an aquifer? Show how it is related to 'Transmissivity' of an aquifer. Also show how hydraulic conductivity is related to groundwater velocity. 20

   (b) What is the reason for systematic repetition of marine magnetic anomalies on opposite side of mid-oceanic ridges? What is Bouger correction in gravity survey? 20

4. (a) What do you understand by Landslides? Briefly describe the different types of landslides and their characteristic features. 20

   (b) Define Compressional and Shear waves. Draw the variation of P wave and S wave velocities within the interior of the Earth and describe the various discontinuities with respect to the above velocity variation. 20

5. (a) Describe the different types of orbiting satellites and their characteristics features. What is atmospheric window? Give a detailed account on the basic components of GPS. 20

   (b) Describe the salient features that are to be given importance in selecting sites for construction of a dam. 20

Group-B

Answer *any two* questions.

6. (a) Discuss briefly on the classification of Gondwana Supergroup of rocks in India. 20

   (b) What is an Index fossil? Briefly discuss the significance of Index fossils. 20

7. (a) Describe in brief, about the hard part morphology of Brachiopods. 20

   (b) Give an account of the Cuddapah Group of rocks with special reference to its mineral wealth. 20

8. (a) What is glacial activity? Explain the terms 'Moraines', 'Drumlins', 'Eskers' and 'Kames'. 20

   (b) Give an account of geological work of wind explaining briefly some major geological features produced by this agency on the land surface due to erosion and deposition. 20

2021

GEOLOGY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. Answer *any four* questions. All questions carry equal marks. 10×4=40

   (a) A mineral section remains dark in all positions under crossed polars. — Explain how will you proceed to determine whether the mineral is isotropic, uniaxial or biaxial.

   (b) Explain why all quartz grains in a rock section do not show first order yellow interference colour when viewed under crossed polars.

   (c) What is 'pleochroism'? Explain why a section of Biotite cut parallel to cleavage does not show any pleochroism but when it is cut oblique to cleavage shows pleochroism.

   (d) Distinguish between 'concordant' and 'discordant' bodies of igneous rocks. Illustrate the following with diagrams: (i) laccoliths and (ii) lopoliths.

   (e) Differentiate between Transform and Transcurrent faults.

   (f) Discuss briefly on 'Supergene sulphide enrichment'. Cite two examples to illustrate your views.

   (g) Discuss on the basic differences in the crystal structures, physical and optical properties of pyroxene and amphibole?

2. (a) What are the differences between Banded Iron Formation and Ironstone? Why are Banded Iron Formation practically devoid of detrital component? 20

   (b) Discuss Bowen's Reaction Series. What is its significance in the process of crystallization of magma? 20

3. (a) With the help of neat sketches, bring out the difference between porphyritic and poikilitic type of textures in igneous rocks. 10

   (b) Describe with neat sketches how would you determine the pleochroic scheme of a biaxial mineral. 20

(c) A uniaxial mineral has the following refractive indices (r.i):

$\omega = 1.540$

$\xi = 1.638$

Determine its birefringence and its optic sign. Give reasons to your answers. 10

4. (a) Explain the classification of Sedimentary rocks giving examples. What do we understand by 'structures' of sedimentary rocks? How these are related to environment of formation of sedimentary rocks? Give examples. 20

(b) Briefly describe how ore concentrates are produced from run-off mine by mineral beneficiation. 20

5. (a) Explain basic differences between the terms "Metamorphic Facies", "Metamorphic Grade" and "Metamorphic Zones". 20

(b) Comment briefly on the following: 10×2=20

(i) Ray velocity surface and Indication of Uniaxial positive mineral

(ii) Mohs' scale of hardness

Group-B

Answer *any two* questions.

6. (a) How oil reserves are formed and accumulated in nature? What are the different types of oil traps? Illustrate with neat diagrams. 20

(b) What is an 'ore'? Define the terms 'cut-off grade', 'tonnage', 'clarke value' and 'enrichment factor'. Are gangue minerals always useless? 20

7. (a) What is rank of coal? Discuss the general changes that coal may undergo during its increase in rank. 20

(b) Answer the following: 10×2=20

(i) Write short notes on: Supergene enrichment and Placer deposits

(ii) Briefly discuss the different ore-forming processes in sedimentary environment.

8. (a) Comment briefly on possible sources of fluoride pollution in groundwater in India. Also mention the states that are affected in India. 20

(b) What is polymorphism? What are the different types of polymorphism? How the reconstructive polymorphism differs with displacive polymorphism? Illustrate with examples. 20

2021

FRENCH

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

1. Faites des phrases avec les expressions suivantes (dix de votre choix) 20

   Mieux vaut tard que jamais, En dépit de, Quand même, Pourvu que, Dans l'optique de, A ciel ouvert, En face de, Contrairement à, Faire la déclaration, Cuisiner quelqu'un, De côté et d'autre.

2. Changez de la voix active à la voix passive 20

   a. Subhas a envoyé la lettre hier.

   b. On rangera les livres avant la fin de la semaine.

   c. Swagata a pris ces photographies.

   d. Les policiers viennent d'expulser ces jeunes clandestins.

   e. Enfin, l'écrivain envoie le manuscrit à un éditeur.

   f. Le volume de la musique gênait les voisins.

   g. 7 mai : Election d'Emmanuel Macron à la présidence.

   h. Le facteur distribue le courrier.

   i. Il est souhaitable que les enfants chantent ce refrain.

   j. Charles aura lavé le chien.

3. Remplissez avec les prépositions appropriées. 10

   a. Ashirbani a un bon sac. Est-il _____ cuir ?

   b. Il habite _____ Japon depuis son enfance.

   c. J'ai donc dû choisir un autre métier et j'ai appris _____ piloter des avions.

   d. Quand il est midi _____ États-Unis, le soleil, tout le monde le sait, se couche _____ la France.

   e. La petite femme était debout devant la table et elle versait le thé _____ les bols.

   f. « Dis-moi, comment et la lumière _____ toi ».

   g. Rajdeep est le plus grand _____ ses collègues.

   h. Aujourd'hui, je vais jouer au foot _____ mon frère.

   i. _____ Sophie, j'ai terminé mon devoir plus vite.

4. Remplissez avec les formes appropriées des verbes dans le passé composé, imparfait ou plus-que-parfait. 10

   a. Rabindranath Tagore _____ (naître) en 1861 et il _____ (mourir) en 1941.

   b. Il _____ (se souvenir) qu'il _____ (oublier) l'anniversaire de sa sœur..

   c. Marie _____ (rire) très fort lorsque Chantal _____ (raconter) son histoire.

   d. Tous les jours, je _____ (se lever) à la même heure et je ne _____ (voir) pas pourquoi changer.

   e. Lorsque j' _____ (être) jeune, moi et ma sœur _____ (aimer) regarder la télé.

5. Remplissez avec l'article partitif. 20

   a. Ce matin, je mange _____ tartines et je prends _____ café.

   b. Ses parents jouent un peu _____ piano.

   c. Je n'ai pas mangé _____ pain.

   d. Elle prendra _____ thé sans citron.

   e. Il faut avoir _____ patience avec les enfants.

   f. Tu peux acheter _____ viande.

   g. Dans le journal, il y a _____ nouvelles et _____ publicité.

   h. Ajoutez s'il vous plaît _____ haricots verts et du brocoli au potage.

6. Transformez les phrases suivantes de discours directs à discours indirect. 10

   a. Kaushik promet à sa femme : « Je t'emmènerai à Kalimpong pour ton anniversaire. »

   b. Je vais lui dire : « Je ne suis pas satisfaite de votre travail. »

   c. Le client exigea : « Remboursez-moi immédiatement. »

   d. « Selon moi », déclara l'expert, « cette maison n'a pas été construite dans les règles de l'art. »

   e. « Comment tu t'appelle » me demande le professeur.

7. Remplacez par l'adverbe qui convient. 10

   a. Je décore ma chambre _____ (simple).

   b. Il leur a _____ (lent) expliqué le fonctionnement de la machine.

   c. Certains candidats ont répondu _____ (excellent).

   d. Quand tu seras parti, tu vas _____ (énorme) me manquer.

   e. Ishan a été _____ (vrai) gentil avec moi..

8. Complétez les phrases suivantes par Qui, Que, Dont, Où, Ce qui, Lequel, Laquelle, Auxquels, Duquel. 20

   a. La chaise sure _____ il est assis était à mon grand-père.

   b. L'actrice _____ j'ai oublié le nom joue très bien.

   c. C'est une comédienne _____ est célèbre dans le monde entier.

   d. Ce sont des problèmes _____ nous devrons nous occuper.

   e. Quel est le bureau _____ on vous a donné ces prospectus?

   f. Elle est arrivée en retard, _____ est habituel.

   g. C'est le jouer _____ j'ai vu au match.

   h. C'est le livre pour _____ elle est connue.

   i. Voilà l'homme à côté _____ Marc s'asseyait.

   j. Les animaux _____ on donne le fourrage sont restés à l'étable.

9. Traduisez en anglais (deux au choix) 20×2=40

   a. Le prince Olaf, qui vient de rentrer en Norvège, estime que les « collaborateurs » représente 2 % de la population totale. Nul doute que le pourcentage n'ait été en France à peu près analogue. Une enquête dans les différents pays occupés permettrait d'établir une sorte de pourcentage moyen des collaborateurs dans les collectivités contemporaines. Car la collaboration, comme le suicide, comme le crime, est un phénomène normal. Seulement, en temps de paix ou dans les guerres qui ne se terminent pas par un désastre, ces éléments de la collectivité demeurent à l'état latent; comme les facteurs déterminants font défaut, le « collaborates » ne se manifeste ni à autrui, ni à lui-même, il vaque à ses affaires, il est peut-être patriote, car il ignore la nature qu'il porte en lui et qui se révélera un jour dans des circonstances favorables.

   b. « Ami lointain, je vous remercie de votre sympathie. Je suis heureux que mon Jean-Christophe ait trouvé dans votre cœur tant d'échos. Ce m'est une preuve de plus de la fraternité universelle des âmes. Cette fraternité, j'y crois et je travaille à en établir la conscience profonde entre les hommes de tous les peuples, de toutes les races. Tout particulièrement, je sens, depuis quelques années, le besoin urgent de rapprocher l'esprit de l'Europe de celui de l'Asie. Ni l'un ni l'autre ne se suffit à soi seul. Ce sont les deux hémisphères de la pensée. II faut les réunir. Que ce soit la grande mission de l'âge qui va venir ! .., »

   c. Je m'appelle Bitna. J'ai bientôt dix-huit ans. Je ne peux pas mentir car j'ai les yeux clairs, et ça se verrait tout de suite dans mes yeux. Mes cheveux aussi sont clairs, il y a des gens qui pensent qu'ils sont décolorés à l'eau oxygénée, mais c'est comme ça que je suis née, avec des cheveux couleur de maïs, parce que ma grand-mère a souffert de carences après la guerre et ma mère aussi. Je suis née au sud, dans la province de Jeolla-do, dans une famille de marchands de poissons. Mes parents ne sont pas riches, mais ils ont voulu, quand j'ai terminé mes études secondaires, me donner la meilleure éducation, et pour cela

ils ont cherché une université du ciel (Sky University) et fait un emprunt. Pour le logement, je n'ai pas eu de problèmes au début, car ma tante (la sœur aînée de mon père) acceptait de me loger dans son minuscule appartement du quartier Yongse, juste à côté de l'université, où je partageais une chambre avec sa fille, nommée Paek Hwa, qui en vérité portait bien mal son nom de fleur immaculée.

20×2=40

10. Traduisez en français (deux au choix)

a. Here is an astounding and significant fact: Mental work alone can't make you tired. Sounds absurd. But a few years ago, scientists tried to find out how long the human brain could labor without reaching "a diminished capacity for work," the scientific definition of fatigue. To the amazement of these scientists, they discovered that blood passing through the brain, when it is active, shows no fatigue at all! If you took blood from the veins of a day laborer while he was working, you would find it full of "fatigue toxins" and fatigue products. But if you took a drop of blood from the brain of an Albert Einstein, it would show no fatigue toxins whatever at the end of the day.

b. Nelson Mandela was an activist and the former president of South Africa who became a global advocate for human rights. He was deeply involved in anti-colonial politics and anti-apartheid movements. Nelson Rolihlahla Mandela, also known as Nelson Mandela, was born on July 18, 1918, to Nosekeni Fanny and Gadla Henry Mphakanyiswa. At the age of seven Mandela was sent to a Methodist school where he got his first name 'Nelson' from a teacher. Post his father's death, his mother entrusted him to Chief Jongintaba Dalindyebo who treated Mandela as his own child.

c. Having seen Grandfather handle the python with such ease and confidence, I decided I would do likewise. So the next time I saw the snake climbing the ladder to the roof, I climbed up alongside him. He stopped, and I stopped too. I put out my hand, and he did over my arm and up to my shoulder. As I did not want him coiling round my neck, I gripped him with both hands and carried him down to the garden. He did not seem to mind.

The snake felt rather cold and slippery and at first he gave me goose pimples. But I soon got used to him, and he must have liked the way I handled him, because when I set him down he wanted to climb up my leg. As I had other things to do, I dropped him in a large empty basket that had been left out in the garden. He started out at me with unblinking, expressionless eyes. There was no way of knowing what he was thinking, if indeed he thought at all.

2021

FRENCH

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

Groupe A

Écrivez toutes les questions. Chaque question porte 10 points. 10×8=80

1. Ecrivez au moins quatre différences entre le classicisme et le romantisme. Nommez deux poètes romantiques de 18ème siècle.
2. Que comprenez-vous par le terme « Roman-fleuve »? Expliquez avec des exemples.
3. Écrivez une petite note sur « Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers ».
4. Quelles sont les caractéristiques du théâtre néoclassique français.
5. Écrivez une petite note sur l'absurdisme. Nommez deux écrivains absurdes.
6. Que comprenez-vous par le terme symbolisme? Nommez deux poètes symbolistes françaises.
7. Écrivez une note sur « Chansons de geste ».
8. Qu'est-ce que la comédie? Ecrivez une note courte sur les comédies de Molière.

Groupe B

Écrivez toutes les questions. Chaque question porte 20 points. 20×6=120

1. Ecrivez une appréciation critique sur le poème « Quand au temple nous ... » de Ronsard?
2. Ecrivez un petit essai sur le personnage de Frosine dans « L'avare » de M...
3. Ecrivez votre observation sur « L'unité de lieu », « L'unité de temps » et « ... » « Le Cid » de Corneille.
4. Décrivez le personnage de Don Diègue dans « Le Cid » ... Corneille.
5. Est-ce que «Tristesse» d'Alfred de Musset est un poème mélanco...
6. Décrivez le personnage d'Elise dans « L'avare » de Molière.

2021

FRENCH

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate marks for each question.

Groupe A

Écrivez toutes les questions. Chaque question porte 10 points. 10×8=80

1. Ecrivez au moins quatre différences entre le classicisme et le romantisme. Nommez deux poètes romantiques de 18ème siècle.
2. Que comprenez-vous par le terme « Roman-fleuve »? Expliquez avec des exemples.
3. Écrivez une petite note sur « Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers ».
4. Quelles sont les caractéristiques du théâtre néoclassique français.
5. Écrivez une petite note sur l'absurdisme. Nommez deux écrivains absurdes.
6. Que comprenez-vous par le terme symbolisme? Nommez de deux poètes symbolistes françaises.
7. Écrivez une note sur « Chansons de geste ».
8. Qu'est-ce que la comédie? Ecrivez une note courte sur les comédies de Molière.

Groupe B

Écrivez toutes les questions. Chaque question porte 20 points. 20×6=120

1. Ecrivez une appréciation critique sur le poème « Quand au temple nous serons » de Ronsard?
2. Ecrivez un petit essai sur le personnage de Frosine dans « L'avare » de Molière. .
3. Ecrivez votre observation sur « L'unité de lieu », « L'unité de temps » et « L'unité d'action » dans « Le Cid » de Corneille.
4. Décrivez le personnage de Don Diègue dans « Le Cid » de Corneille.
5. Est-ce que «Tristesse» d'Alfred de Musset est un poème mélancolique? Justifiez votre réponse.
6. Décrivez le personnage d'Elise dans « L'avare » de Molière.

2021

ANIMAL HUSBANDRY AND VETERINARY SCIENCE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be given either in ***English*** *or in* ***Bengali*** but all answers must be in one and same language.

Group-A

Answer *any three* questions.

1. (a) What is silage? What factors to be considered during silage making? What are the characteristics of good silage? Write the principle of fermentation in silo. 2+5+2+6=15

   (b) What is TDN? What are the factors affecting TDN value of feed? Write merits and limitations of TDN. What do you mean by Kellner's Starch Equivalent (SE)? 2+4+4+5=15

   (c) What is balanced ration? What is maintenance ration? Write the characteristic of balanced ration. 2+2+6=10

2. (a) Write down the different techniques for the diagnosis of bovine pregnancy. What are the limiting factors for success of embryo transfer under field condition? 6+6=12

   (b) Classify anoestrus. How will you treat a case of true anoestrus? Enumerate the causes, diagnosis and therapeutic management of repeat breeder cows. 2+6+8=16

   (c) Enumerate the differential points between estrous cycle of bovine and canine. How to diagnose uterine torsion in bovine? 6+6=12

3. (a) Define Genetics. Mention Mendel's laws of inheritance. What are the different cases of modified Mendelian inheritances? Discuss with suitable examples. 2+5+8=15

   (b) What is Selection? Mention different methods of selection. What is response to selection and what are the factors affecting it? 2+9+4=15

   (c) Write down the classification of mating systems. Discuss in brief, about different forms of outbreeding. 3+7=10

4. (a) What is adulterant milk and describe the different adulterant used in milk and milk products. 10

   (b) What is CIP and describe its important roles in modern dairy processing plant. 10

(c) Describe the FSSAI guidelines on FSMS compliance for meat and meat products. 10

(d) What are the different elements for hygienic meat production and what is the role of a Veterinarian for clean meat production? 10

5. (a) Write in details, about methods of Animal identification with their advantages and disadvantages. 15

(b) Write importance of agro-forestry in fodder production. Why the Lucerne is termed as 'Queen of forages'? Write in details, about agronomic practices of Lucerne crop. 7+2+6=15

(c) What are the preliminary cares of the calf after parturition? Write in details, about farrowing management. 5+5=10

Group-B

6. Answer *any four* (4) of the following: 10×4=40

(a) Describe the Roughage processing method.

(b) Factors affecting the puberty and sexual maturity in bull.

(c) Discuss in details, about different chromosomal aberrations with suitable examples.

(d) Write the principle of egg preservation and describe the different preservative methods of egg and egg products.

(e) Organic livestock production system ensures better animal welfare — Justify.

(f) Discuss in brief, about different livestock development programmes during pre and post independence period of India.

7. Write briefly on *any five* (5) of the following: 8×5=40

(a) Write classification of minerals and its role in livestock.

(b) Causes of infertility and its therapeutic management in bovines.

(c) Define meiosis and discuss in details about the different stages of meiosis.

(d) What is artificial egg and how to differentiate the artificial egg and natural eggs?

(e) Write about the different types of housing system of cattle.

(f) Define Sociology and discuss about different rural institutions in the context of Indian social system.

(g) Discuss about the different steps to be followed while formulating programme planning in livestock development.

2021

ANIMAL HUSBANDRY AND VETERINARY SCIENCE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in **English** *or in* **Bengali** *but all answers must be in one and same language*

Group-A

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

1. Write in brief, on *any ten* of the following:-

   (a) Classify the brain and write the structure of Mid brain. 5+5=10

   (b) Mention the Cranial Nerves and write in course of 5th Cranial Nerve and its branches. 3+7=10

   (c) Write the structure and function of Nephron. 5+5=10

   (d) What is full form of TCA cycle? Write in details of TCA cycle. 2+8=10

   (e) Write with diagram of oviduct of hen and digestive tract of fowl. 5+5=10

   (f) Mention the causes of vaccination and deworm in dog. Write the function of sweat gland. 5+5=10

   (g) Differentiate between organophosphorus compound and organochlorine compound. Describe the treatments of both insecticide poisoning in Cattle. 5+5=10

   (h) Write in difference exotoxin and endotoxin. 10

   (i) What is Microbial toxin? Draw and lable a bacterial growth curve. 4+6=10

   (j) State the layers of retina. 10

   (k) Write in details of metabolism of glycogen in muscle. 10

   (l) Describe the movement of synovial joint. 10

2. Write the different species of Babesia in Cattle. Describe in details pathogenesis, diagnosis and treatment of Babesiosis. 2+6+6+6=20

3. What is Milk fever? Write clinical finding, diagnosis and treatment of Ketosis. 2+6+6+6=20

4. Write the mechanism of action of penicillin, tetracycline and fluroquinolones. Name some locally acting antifungal drugs. Write the mechanism of action of gresiofulvin and azole antifungal drug. 10+5+5=20

Group-B

Answer *any two* questions.

5. Write in brief: 6×5=30

   (a) opening of pharynx

   (b) Fever

   (c) Function of liver

   (d) Importance of fibre in rabbit diet

   (e) Nutrient requirement of Mice

6. What is bloat? Write clinical findings, diagnosis and treatment of bloat. 3+9+9+9=30

7. Write short notes on the following:- 6×5=30

   (a) Function of lungs with its structure.

   (b) Snake bite

   (c) Ligament of liver

   (d) Mention feeding schedule of rabbit in different stage

   (e) Inguinal hernia and its surgical treatment

2021

ELECTRICAL ENGINEERING

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answer may be written either in **English** or in **Bengali** but all answers must be in one and the same language.*

All symbols have their usual significance.

Group-A

Answer *any three* questions.

1. (a) Use superposition theorem to find the value of voltage 'v' in the network of Fig-1. 10

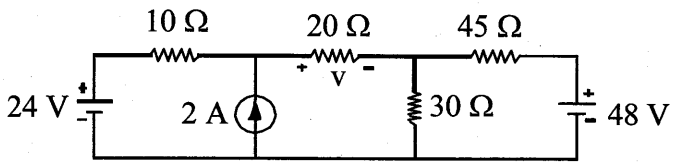
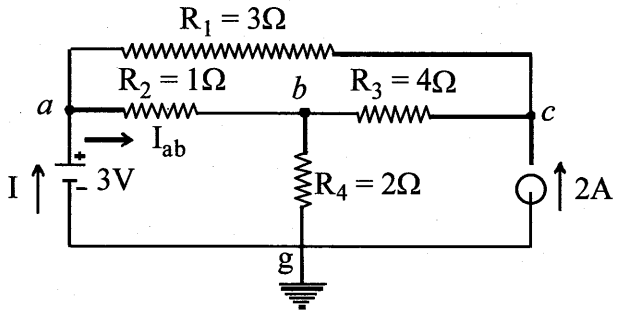
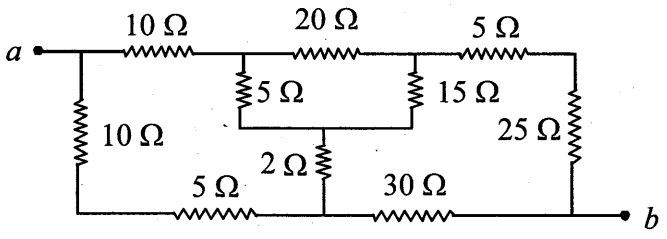


Fig-1

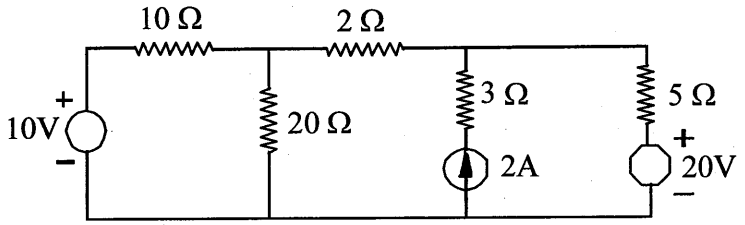
(b) Find the current through branch '*ab*' (I_{ab}) and voltage (V_{cg}) across the current source using node voltage method. 10



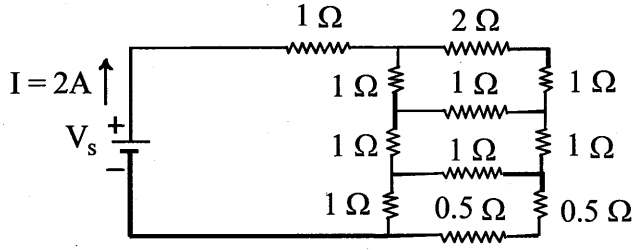
(c) Determine the resistance between terminals '*ab*' of the network shown below. Deduce the formula you have used. 20



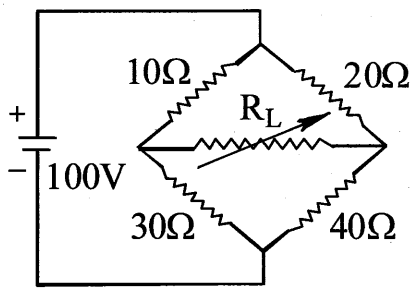
2. (a) Find the voltage across 2Ω resistor by using superposition theorem for the network shown below. 10



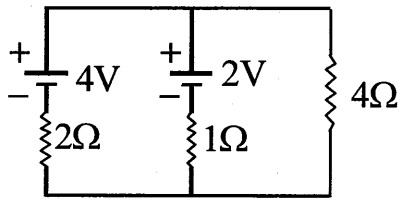
(b) Find the value of the voltage source (V_s) that delivers 2 Amps current the circuit shown below. 10



(c) Determine the load resistance R_L, shown in the circuit below, to receive maximum power from the source; also find the maximum power delivered to the load. 15



(d) Using Norton's theorem determine the current flowing through the 4Ω resistance as shown in the network below. 5



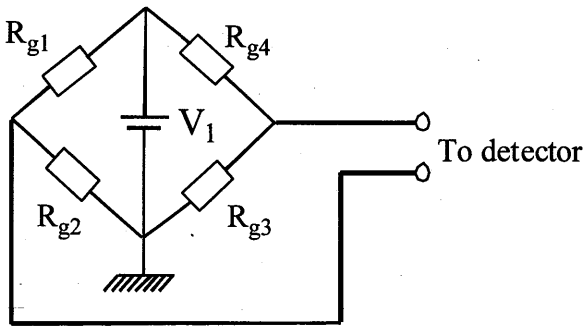
3. (a) A voltage of 120V at 50Hz is applied to a resistance, R in series with a capacitance C. The current drawn by the combination is 2A and the power loss in the resistance is 100W. Calculate the values of resistance and capacitance. Draw the phasor diagram. 7+3=10

(b) A constant voltage of frequency, 1MHz is applied to a lossy inductor in series with a variable capacitor C. The current drawn is maximum when C = 400 pF; while current is reduced to $(1/\sqrt{2})$ of the above value, when C = 450 pF. Find the values of resistance and inductance of the inductor. Also calculate the quality factor of the coil and bandwidth of the coil. 10

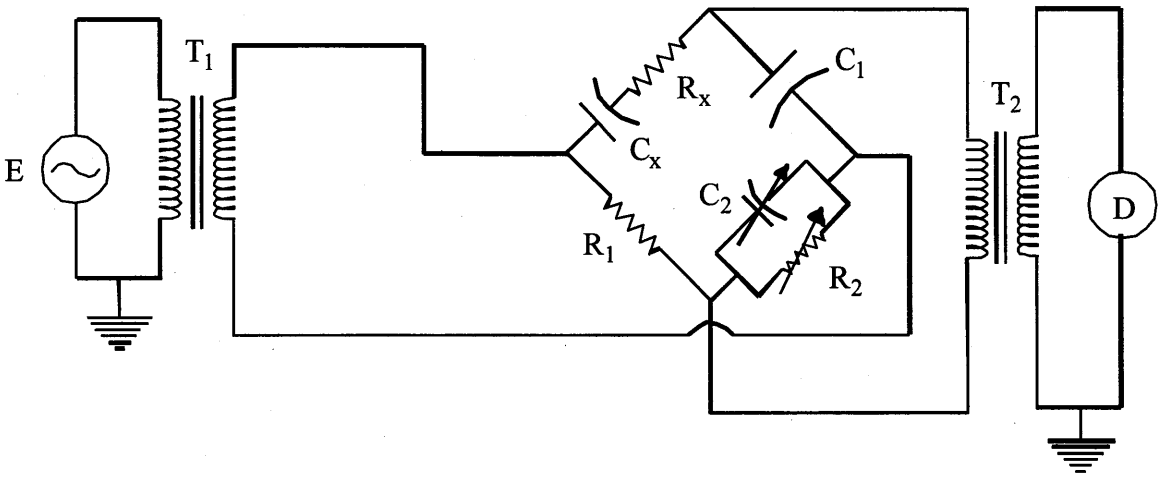
(c) Three loads are delta connected to a symmetrical three phase, 440V system frequency 50Hz. Load A takes 25kW at unity power factor, load B takes 40 kVA at power factor 0.9 leading and load C takes 45 kVA at power factor 0.7 lagging. Calculate the line currents and the readings of two watt meters connected to measure the power input. The current coil of W_1 is connected in line R to the junction of A and C, the current coil of W_2 in line Y to the junction of A and B. Phase sequence RYB. 20

4. (a) Explain the operation of a successive approximation type A/D converter with flowchart. 10

(b) Find the bridge sensitivity for Wheatstone bridge arrangement based strain measurement system with four identical active strain guages (i.e. guage resistances $R_{g1} = R_{g2} = R_{g3} = R_{g4}$) as shown in figure below. 10



(c) What is the use of Schering bridge? For the following circuit diagram explain bridge balance equation. 10



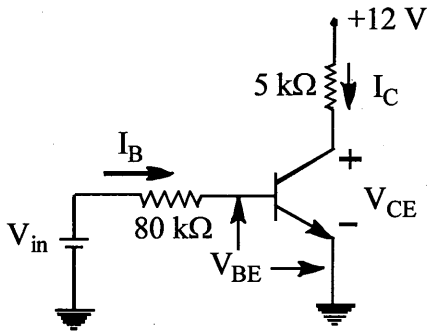
(d) Why the CRO probes are to be designed properly for accurate signal representation? Explain with the help of a diagram. 10

5. (a) Determine the minimum value of current gain β required to put the transistor, shown in figure, in saturation when 10

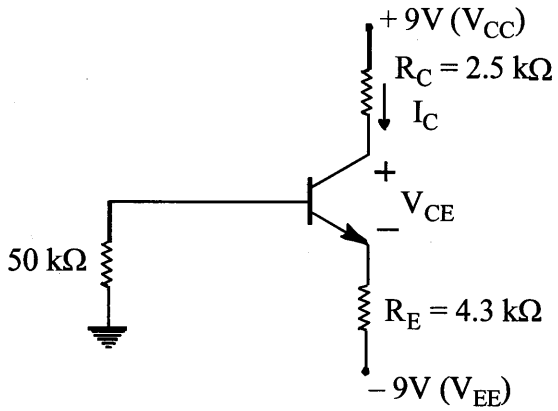
V_{in} = + 5V

Assume, $V_{BE(sat)}$ = 0.8V,

$V_{CE(sat)}$ = 0.12V



(b) Find the operating point current I_{CQ} and voltage V_{CEQ} in the circuit shown below. Given V_{BE} = 0.7V, β of transistor is 200. 10



(c) Simplify the following Booleen function:

F(A, B, C) = πM (0, 1, 5, 7, 8, 9, 15) 10

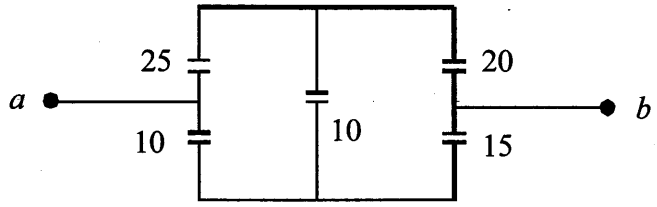
(d) Design all the gates i.e. NOT, AND, OR, NAND, NOR, XOR and XNOR using 2 : 1 multiplexer. 10

Group-B

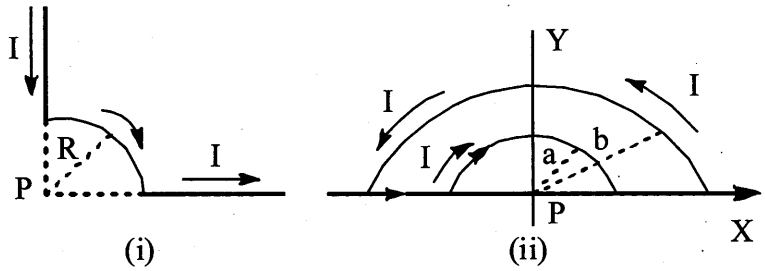
Answer *any two* questions.

6. (a) Three charges q_1, q_2 and q_3 lie on the x-axis at $x = x_1$, x_2 and x_3 respectively. Find the flux produced by all the three charges through a circle of radius a, normal to the x-axis with its centre at the origin (0, 0, 0). 10

(b) Determine the capacitance of the combination between terminals *a* and *b* as shown in figure below. All the values of the capacitances are in microfarads. 10



(c) Calculate the magnetic field at point P due to the following current distributions. 10



(d) Inductance of a closely wound coil is such that when the current changes by 5A per second, it induces electromotive force of 3mv. Furthermore, a steady current of 8A generates in each loop of the coil a magnetic flux of 40 μwb.

(i) Calculate the inductance of the coil.

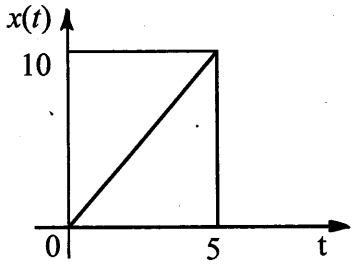
(ii) Determine the number of loops of the coil. 10

7. (a) Check whether the following signal is a power signal or energy signal 5

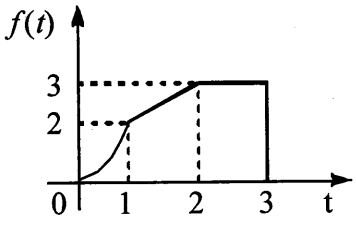
$x(t) = e^{-\alpha t}$, $t > 0$, $\alpha > 0$

$= 0$, elswhere

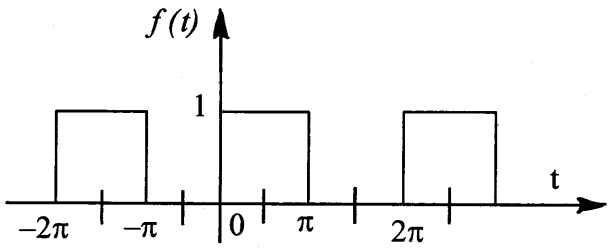
(b) Resolve $x(t)$ into even and odd components. 5



(c) Express following function in terms of singularity functions: 10



(d) Find Fourier coefficients, Amplitude and Phase spectra for the following signal $f(t)$. 20



8. (a) A unity feedback system with the following forward path transfer function oscillates at 2 rad/sec.

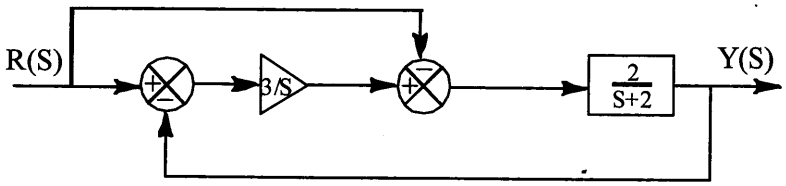
$$G(s) = \frac{K(s+1)}{s^3 + as^2 + 2s + 1}$$

Find the values of K and a. 12

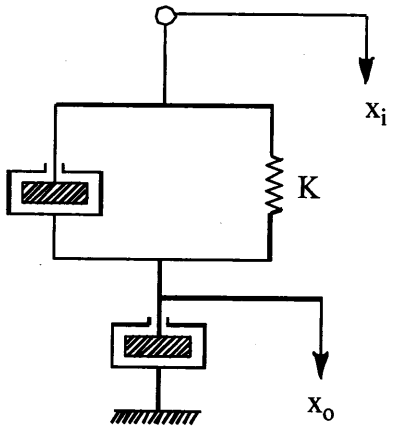
(b) Obtain the transfer function for the system describe by the state-space equations of the form. $\dot{x} = Ax + Bu,\ y = Cx$

with $A = \begin{bmatrix} 0 & 1 \\ 0 & -2 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ $C = \begin{bmatrix} 1 & 0 \end{bmatrix}$ 8

(c) Obtain the steady state error for the system shown in figure below, when subjected to a unit step input. 12



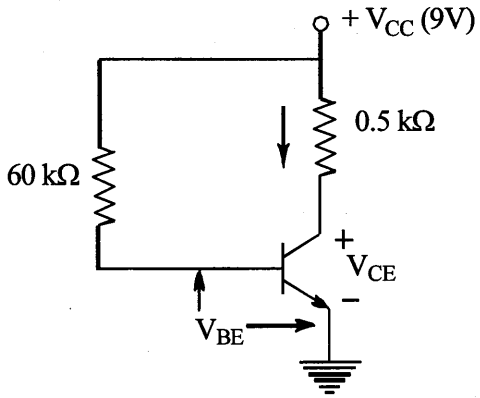
(d) Consider the mechanical system shown in figure below. Obtain the transfer function of the system taking the displacement x_i as the input and x_o as the output. Comment whether it is a mechanical load network or lag network. 8



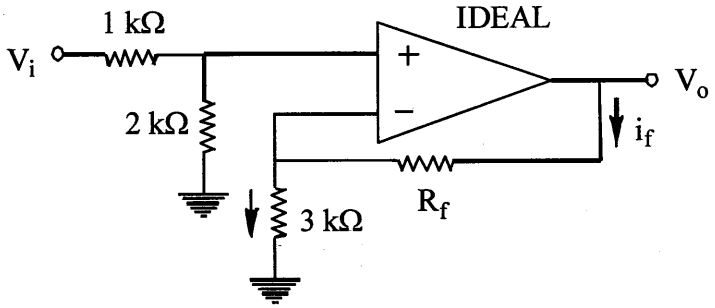
9. (a) The fixed bias circuit shown in figure below is a silicon transistor with $V_{BE} = 0.7V$.

(i) Find the collector current, I_C and voltage V_{CE}, if β of transistor is 60.

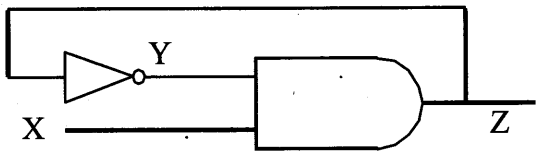
(ii) Find I_C and V_{CE} if β changes to 80. State what conclusion may be drawn. 15



(b) For the ideal op-amp shown, what should be the value of resistor R_f to obtain a gain of 5? 5



(c) Assume that the inverter in the network below has a propagation delay of 5 ns and the AND gate has a propagation delay of 10 ns. Draw a tuning diagram for the network showing X, Y and Z. Assume that X is initially 0, Y is initially 1, X becomes 1 for 80 ns and then X is 0 again. 10



(d) Write an assembly language program for 8085 microprocessor to multiply two eight bit numbers, the result may contain sixteen bits. 10

8. (a) A lamp of 500 C.P. is suspended 4 metres above a horizontal surface. Calculate the illumination. 10

(i) directly below the lamp

(ii) 3 meter away from the vertical axis

(b) A slab of insulating material 150 cm^2 in area and 1 cm. thick is to be heated by dielectric heating. The power required 400 watts at 30 MHz. Material has permittivity of 5 and P.f. 0·05. Determine the voltage necessary, Absolute permittivity = $8{\cdot}854\times10^{-12}$ F/m (R.M.K.S). 10

(c) Explain with the help of a circuit diagram the working of a fluorescent lamp. Discuss the difference between electronic and magnetic blast. 20

---

5. (a) State and explain 'equal area' criterion in connection with transient stability analysis. What are the advantages of this method? What are its Limitations? 20

(b) Single line diagram of a simple 4-bus system is given in Fig.-2. The relevant per unit line impedance are indicated on the diagram. The shunt admittances at the buses may be neglected. Determine Y_{bus} if buses 1 and 2 are not conected, as indicated by dotted line in Fig-2. 20

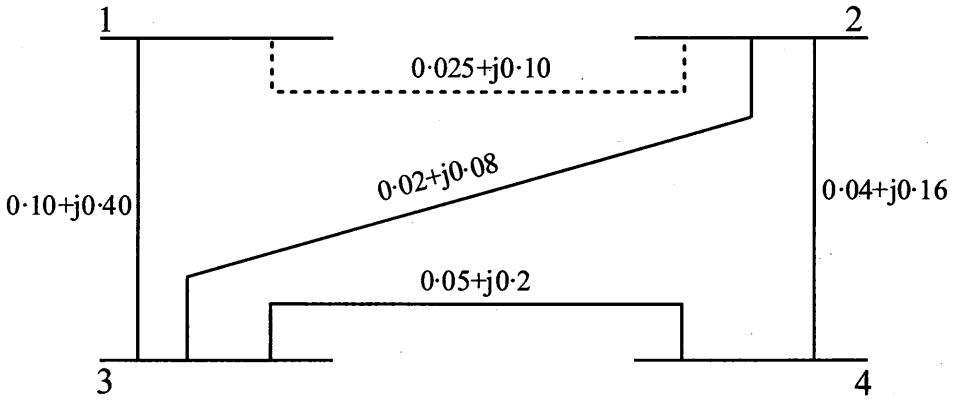


Fig-2

6. (a) Briefly discuss the advantages and the operational problems of HVDC transmission. 15

(b) Explain the various methods of arc extinction of a circuit-breaker. 15

(c) A 6·6 kV, 10 MVA star-connected alternator has a reactance of 2 ohms per phase and negligible resistance. Merz-Price protection is used for protection of winding. The neutral grounding resistance is 5 ohms. If only 10% of the winding is to be remain unprotected, determine the setting of relay. 10

7. (a) What is modulation? Why is modulation necessary in communication system? 10

(b) What are the advantages of combined working of thermal power plant and hydro-electric plant? Discuss briefly the need for co-ordination of these plants in power system. 15

(c) A thermal energy storage with a storage capacity Q_5 of 300 kWh uses water as a storage medium. The water temperature in the storage varies between 80°C in fully charged state and 29°C in fully discharged state.

Determine the required mass and volume of water as well as the mass and volume related energy density of storage. 10

(d) What is photovoltaic cell or module? 5

3. (a) If stator impedance of an 3-phase induction motor is neglected, show from its equivalent circuit that maximum torque per phase is given by

$$T_{Sm} = \frac{1}{2\pi n_s} \cdot \frac{V_1^2}{2X_2}$$

and hence show that

$$\frac{T_S}{T_{Sm}} = \frac{2}{\frac{S_{mT}}{S} + \frac{S}{S_{mT}}}$$

For small value of slip occuring in the stable operating region 20

$$T_S = \frac{2T_{sm}}{S_{mT}} \cdot S$$

(b) What are ACSR conductors and why are they preferred over copper conductors for overhead lines? Why are the stranded conductors used? 10

(c) A 132 kV transmission line has the following data:

wt. of concuctor = 680 kg/km. Length of span = 260m. Ultimate strength = 3,100 kg; Safety factor = 2.

Calculate the height above ground at which the conductor should be supported. Ground clearance required is 10m. 10

4. (a) Determine the insulation resistance of a single core cable of length 3 km. and having conductor radious 12·5 mm insulation thickness 10 mm and specific resistance of insulation of $5\times10^{12}\,\Omega$-m. 10

(b) A 3-phase, 10,000 kVA, 11 kV alternator has a subtransient reactance of 8%. A 3-phase shortcircuit occurs at its terminals. Determine the fault current and fault MVA. 10

(c) Explain the following: 20

(i) Differentiate between fixed and operating costs of power plants.

(ii) Discuss two part tariff.

(iii) What is necessity of power factor improvement?

(iv) What information can be supplied by load curves?

(v) What is the effect of increasing excitation of one of the two alternators operating in parallel?

2021

ELECTRICAL ENGINEERING

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in **English** *or in* **Bengali** *but all answers must be in one and same language.*

The figures in the margin indicate for each question.
All symbols have their usual significance.

Answer *any five* questions.

1. (a) Describe the 'Synchronous Condenser' operations of Synchronous machine. 10

   (b) Can V-curve be plotted for alternator operation? How it differs from V-curve of a sychronous motor? 10

   (c) The rotating magnetic field of the stator and rotor of a 3-phase induction motor are stationary with respect to each other—Justify. 10

   (d) Explain why D. C. series motor is used in traction. 10

2. (a) A 220V DC shunt motor has an armature circuit resistance of 0·2Ω and field resistance of 110Ω. At no load the motor takes 5A and runs at 1500 r.p.m. If the motor draws 52A at rated voltage and rated load, calculate the motor speed and its roted shaft torque in Nm. The rotational losses at no-load and full load are the same. Neglect armature reaction. 12

   (b) In a 440/220 V, 50 Hz transformer, the total iron loss is 2500 watts. When the applied p.d. is 220 V at 25 Hz, the corresponding loss is 850 watts. Calculate the eddy current loss at normal frequecny and p.d. 8

   (c) (i) Why d.c. series motor should not be started at no load?

   (ii) Why starter is necessary to start a d.c. motor?

   (iii) Why is transformer core laminated?

   (iv) What is the purpose of short-circuit test on a power transformer?

   (v) Discuss the conditions for three-phase transformers running in parallel. 4×5=20

COMMERCE AND ACCOUNTANCY

PAPER – I

Time Allowed — 3 Hours. *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Answer any five (5) questions taking at least one (1) from each group.

Group-A

1. The following Trial Balance relates DE Ltd. 40

Particulars	**Debit (₹)**	**Credit (₹)**
Land at cost	10,000	—
Building at cost	40,000	—
Plant and Machinery at cost	1,00,000	—
Furniture and Fixture at cost	4,700	—
Accumulated Depreciation-Building	—	9,000
Accumulated Depreciation—Furniture & Fixture	—	700
Accumulated Depreciation—Plant and Machinery	—	43,500
Equity Share Capital (10,000 shares of ₹ 10 each)	—	1,00,000
6% Debentures (Secured)	—	25,000
Retained Earnings	—	19,700
Revenue from operations	—	2,29,000
Other Income	—	1,400
Finance cost	2,200	—
Salaries to staff	20,000	—
Electricity	10,000	—
Sundry Expenses	6,000	—
Cost of Sales	1,51,300	—
Inventories on 31.03.2019	35,800	—
Trade Receivables	48,500	—
Trade Payable	—	15,000
Outstanding Liabilities	—	11,700
Cash and Cash Equivalents	36,500	—
Suspense Account (Note 1)	—	10,000
Total	4,65,000	4,65,000

Please Turn Over

Additional information:

(a) The company sold one of its products on 1st April, 2018 at ₹ 10,000. The company has agreed to provide after sales service for a period of 4 years, i.e. 31st March, 2022 without any extra charge. The estimated cost of servicing is ₹ 300 p.a. which is included in the sale price. The company charges 25% gross profit margin on the servicing. The accountant of the company is confused as to accounting treatment of this transaction. Therefore he has recorded ₹ 10,000 as suspense.

(b) The debentures were issued on 1st April, 2018 and issued cost of ₹ 1,000 have been charged to salary to staff account.

(c) Land has been revalued by the company during the year and an independent professional valuer has valued the land at ₹ 12,000. The resultant gain has not been recorded in the above Trial Balance.

(d) Depreciation to be charged as follows:

(i) Building @ 2%

(ii) Plant & Machinery @ 15% and

(iii) Furniture & Fixture @ 10%

All depreciations to be charged on written down value basis. The depreciation for the year has not yet been recorded in the above Trial Balance.

(e) Current tax expenses is to be recorded @ 35% of taxable profit. The tax consultant of the company has calculated current year's taxable profits at ₹ 40,000.

You are required to prepare the following financial statements for the year ending on 31st March, 2019:

(a) Statement of Profit & Loss

(b) Statement of changes in Equity; and

(c) Balance Sheet

Or,

Write notes on: 8×5=40

(a) Going concern concept and comparability characteristic

(b) Conservative principle and reliability characteristic

(c) Difference between Receipts & Payments Account and the Income & Expenditure Account; (6 points)

Difference between the Income & Expenditure Account and the Profit & Loss Account (4 points)

(d) Objectives and benefits of Buy back of shares

(e) Accounting Standard (AS-3): Cash Flow Statement (Revised)

2. X Ltd., whose Balance Sheet as at 31st December, 2018 appears below formulated a scheme of reconstruction, details of which follow and secured approval of all concerned. 40

Balance Sheet of X Ltd. as at 31.12.2018

Particulars	Note No.	Amount (₹)
I. Equity and Liabilities		
1. Shareholders' Funds:		
(a) Share Capital	(1)	8,00,000
(b) Reserve & Surplus–Profit & Loss Account		(2,14,000)
(c) Money Received against share warrants		—
2. Share Application money pending allotment:		—
3. Non-Current Liabilities:		
(a) Long-term borrowings–8% Debentures		3,00,000
4. Current Liabilities:		
(a) Short term Borrowings–Bank Loan		75,000
(b) Trade Payables–Sundry Creditors		34,500
(c) Other Current Liabilities:		
Interest accrued and due on Debentures		54,000
Interest on Bank Loan		7,500
Total		10,57,000
II. Assets		
1. Non-Current Asstes:		
(a) Fixed Assets:		
(i) Tangible Assets:		
Plant and Machinery		5,60,000
(ii) Intangible Assets:		
Plants and Copyrights		40,000
2. Current Assets:		
(a) Current Investments (Market value ₹ 27,500)		32,500
(b) Inventories		—
(c) Trade Receivables–Sundry Debtors		60,000
(d) Cash and Cash Equivalents		—
(e) Short term Loans & Advances		—
(f) Other Current Assets		3,64,500
Total		10,57,000
Notes to Accounts:		
1. Share Capital		
Issued, Subscribed and Paid-up Capital:		
50,000 Equity Shares of ₹ 20 each, ₹ 10 Paid-up		5,00,000
40,000, 8% Preference Shares of ₹ 100 each, ₹ 75 Paid-up		3,00,000
		8,00,000

Preference dividend is in arrears for one year.

(a) Preference Shareholders to give up their claims inclusive of dividends to the extent of 30% and desire to be paid-off.

(b) Debentureholders agree to give up their claims to interest in consideration of their rate of interest being enhanced to 10%.

(c) Bank agrees to give up 50% of their interest outstanding in consideration of their being paid-off at once.

(d) Sundry Creditors would like to grant a discount of 5% if they were to be paid-off immediately.

(e) Balances on Profit & Loss Account, Patents and Copyrights and 25% of the total Sundry Debtors of ₹ 60,000 to be written off. Fixed Assets to be written-down by ₹ 7,000. Investments to reflect their market value.

(f) To the extent not specifically stated equity shareholders suffer no reduction of their rights.

(g) Cost of reconstruction ₹ 1,675.

Pass Journal Entries in the books of the Company assuming that the scheme has been put through fully with the equity shareholders bringing in necessary cash to pay-off the parties and to leave a working capital of ₹ 10,000. Draw the Balance Sheet after reconstruction.

Or,

Write notes on: 10×4=40

(a) Bonus share; Right shares; Stock split.

(b) Further issue of shares (FPO); Depository system; Book-building method of issuing shares; 'Sweat Equity' shares.

(c) Provisions of the Companies Act 2013 with regard to redemption of Redeemable Preferance Shares.

(d) Calculation of Purchase Consideration according to AS-14 and difference between Posting of Interest method and Purchase method.

3. (a) A Ltd. had 6% ₹ 1,00,000 debentures on 01.04.2018. Interest is paid annually on 31st March. The terms of issue provide that the company should pay to the trustees ₹ 12,000 each year to be applied by the trustees in redemption of debentures by purchase below par in the open market. It is also provided that 1/5th of the outstanding balance is to be redeemed from this year. If redemptions by purchase are below the required amount, the balance is redeemable at par by drawing lot on 31st March.

On 01.04.2018, the trustees had ₹ 16,900 represented by 5% investments (Cost ₹ 16,000; Face value ₹ 17,000) and ₹ 900 cash. The trustees purchased ₹ 13,000 debentures at ₹ 96 cum-interest on 30.09.2018 and the balance required was redeemed by lot. For this purpose, ₹ 12,750, 5% investments were sold (ex-interest) for ₹ 11,750, balance being met from cash in hand. Surplus cash in hand was invested to acquire investment of the face value of ₹ 6,000.

You are required to show the following in the books of the company:
(i) 6% Debentures Account, (ii) Debenture Trustees Fund Account, (iii) Debenture Trustees Investment Account, (iv) Debenture Trustees Cash Account and (v) Debenture Interest Account.

(b) Prepare Subscription Account showing subscriptions received in 2018-19.

		₹
(i) Subscriptions Income for 2018-19 as per Income & Expenditure Account	—	82,000
(ii) Advance Subscriptions received in 2017-18	—	4,000
(iii) Subscriptions outstanding at the end of 2018-19 including ₹ 1,000 for 2017-18	—	9,500
(iv) Advance Subscriptions received for 2019-20	—	2,000
(v) Subscriptions written off during 2018-19	—	500
(vi) Subscription receivable on 01.04.2018	—	5,000
(vii) Subscriptions collected for 2018-19 by the Secretary but not deposited	—	1,000
		30+10=40

Or,

From the following Balance Sheets, make out the consolidated Balance Sheet of the group as at 31.12.2018 : 40

Balance Sheets of H. Ltd. and S. Ltd. as at 31.12.2018.

Particulars	**Note No.**	**H. Ltd. (₹)**	**S. Ltd. (₹)**
I. Equity and Liabilities :			
1. Shareholders' Funds:			
(a) Share Capital–Equity share of ₹ 10 each fully paid		4,00,000	5,00,000
(b) Reserves & Surplus–Profit & Loss Account		1,60,000	1,00,000
2. Share Application money pending allotment		—	—
3. Non-Current Liabilities		—	—
4. Current Liabilities:			
Trade Payables–Sundry Creditors		50,000	90,000
–Bills Payable		10,000	15,000
Total		6,20,000	7,05,000
II. Assets			
1. Non-Current Asstes:			
(a) Fixed Assets:			
(i) Tangible Assets		—	3,00,000
(b) Non-current Investments–Shares in S Ltd.		4,50,000	—
2. Current Assets:			
(a) Trade Receivables–Bills Receivable		10,000	8,000
(b) Cash and Cash Equivalents–Cash in hand		10,000	20,000
(c) Other Current Assets		1,50,000	3,77,000
Total		6,20,000	7,05,000

Additional Information :

(i) Net Profit for 2018 (included above) : H Ltd. ₹ 40,000; S Ltd. ₹ 80,000

(ii) In 2018, S Ltd. credited ₹ 4,000 to Profit & Loss Account in settlement of claim for loss of stock (Cost ₹ 5,000, included in the opening stock of the year) by fire on 31.03.2018

(iii) The following points were not considered in making out the accounts:

(a) ₹ 500 p.m. expenses were incurred by H Ltd. on behalf of S Ltd. It was by mistake debited to Profit & Loss Account of H Ltd. and nothing has been done in the accounts of S Ltd.

(b) Dividend proposed for 2018 – 10%

(iv) On 30.04.2018 H Ltd. acquired 32,000 shares at ₹ 4,50,000. On the same day, bonus shares @ one for every four held were received. 10% dividend has also been received on the same day from S Ltd. The dividend have been credited to Profit & Loss Account.

(v) Bills Receivable of H Ltd. include ₹ 5,000 accepted by S Ltd., ₹ 3,000 of which is discounted.

(vi) Sundry Creditors of S Ltd. include ₹ 10,000 due to H Ltd., whereas Sundry Debtors of H Ltd. include ₹ 12,000 due from S Ltd., the difference being represented by a cheque-in-transit.

Group-B

4. (a) The following particulars are taken from the books of accounts of ABC Ltd. for the year ended 31st December, 2018:

Working Capital	₹ 75,000
Current Ratio	1 : 6
Liquid Ratio	1·35
Stock Turnover Ratio	9 times
Debtors' Turnover Ratio	73 days
Asset-Proprietorship (Fixed Assets/Prop. Fund) Ratio	75 per cent
Gross Profit Ratio (on Sales)	25 per cent
Net Profit to Share Capital Ratio	15 per cent
Share Capital	₹ 2,00,000

You are required to prepare a Profit & Loss Account for the year ended 31.12.2018 and a Balance Sheet as on that date with as many details as possible. Assume that there is no long term loan and bank overdraft

(b) From the following records of Apollo Bolt Nut Manufacturing company, you are required to compute material and labour variances:

An input of 100 kg of material yields to standard output of 10000 units. Standard price per kg of material ₹ 20

Actual quantity of material issued and used by Production Deptt. 10000 kg. Actual price per kg of material ₹ 21.

Actual output – 900000 units.

Number of employees – 200

Standard wage rate per employee per day ₹ 40

Standard daily output per employee – 100 units

Total number of days worked – 50 days

(Idle time paid for and included in the above half day for each employee) Actual wage rate per day ₹ 45. 20+20=40

5. From the following comparative summary and information, prepare a statement of sources and applications of funds : 40

	31.12.2018 (₹)	**31.12.2017** (₹)
Liabilities :		
Sundry Creditors	1,43,000	1,12,000
Dividend Payable	25,000	—
Provision for Taxation	48,000	8,000
Accrued Interest on Debentures	3,000	3,750
6% Debentures	1,00,000	1,25,000
Share Capital	5,75,000	5,25,000
Reserves	2,52,000	2,52,000
Surplus	59,070	1,75,535
	12,05,070	12,01,285
Assets :		
Cash and Bank balance	2,87,800	1,70,650
Sundry Debtors	1,53,000	1,38,760
Inventories	2,87,670	2,35,800
Prepaid expenses	4,600	3,200
Investments	25,000	1,05,000
Debentures discount	5,000	6,875
Patents	24,000	30,000
Goodwill	5,000	85,000
Property, Plant & Equipment less depreciation	4,13,000	4,26,000
	12,05,070	12,01,285

Additional Information :

(i) Depreciation on Property, Plant & Equipment amounts to ₹ 4,24,000 on 31.12.2017 and to ₹ 4,11,000 on 31.12.2018. Depreciation for the year ₹ 66,000.

(ii) A machine was sold for ₹ 20,000. At the time of sale, the net book value of the machine was ₹ 30,000 (cost ₹ 70,000 and accumulated depreciation ₹ 40,000).

(iii) Investments costing ₹ 80,000 were sold for ₹ 1,00,000.

(iv) During the year 2018, debentures of the face value of ₹ 25,000 were redeemed at a premium of 5 per cent.

(v) The Surplus as at 31.12.2018 was arrived at as under :

	₹
Balance as on 31.12.2017	1,75,535
Less : Net loss for the year after providing for all write-offs	66,465
	1,09,070
Less : Dividend declared	50,000
	59,070

6. (a) XYZ Company buys in lots of 500 boxes which is a 3 months supply. The cost per box is ₹ 125 and the ordering cost is ₹ 150. The inventory carrying cost is estimated at 20% of unit value. What is the total annual cost of the existing inventory policy? How much could be saved by employing the economic order quantity?

(b) The standard hours of job X is 100 hours. The job has been completed by Urjit in 60 hours, Raghu in 70 hours and Sashi in 95 hours. The bonus system applicable to the job is as follows:

Percentage of time saved to time allowed	**Bonus**
Saving upto 10%	10% of time saved
From 11% to 20%	15% of time saved
From 21% to 40%	20% of time saved
From 41% to 100%	25% of time saved

The rate of pay is ₹ 10 per hour. Calculate the total earnings of each worker and also the rate of earnings per hour.

(c) The following costs and sales of a manufacturing company for the first half and second half are given :

	First half	Second half
	₹	₹
Sales	24,00,000	30,00,000
Total costs	21,80,000	26,00,000

You are asked to determine:

(i) Contribution/Sales Ratios of the firm

(ii) Annual Fixed Cost

(iii) Break-even Point

(iv) Margin of Safety as percentage of Sales

12+12+16=40

Group-C

7. (a) Mr. K Gupta, a resident individual, is the owner of 4 house properties in Kolkata, From the following particulars compute his income from house property for the P.Y. 2018-19.

Particulars	**A**	**B**	**C**	**D**
used for	Tenant's Business	Tenant's residence	Own residence	Own business
Gross Municipal value	₹ 40,000	₹ 30,000	₹ 30,000	₹ 20,000
Rent received	₹ 3,000 p.m.	₹ 2,750 p.m.	—	—
Fair Rent	₹ 38,000	₹ 35,000	₹ 32,000	₹ 25,000
Repair expenses	₹ 5,000	Nil	₹ 2,000	₹ 1,000
Interest on loan	—	₹ 15,000 (paid)	₹ 25,000 (unpaid)	—
Municipal Tax Paid (10%)	6 quarters (with previous two quarters)	5 quarters (with coming one quarter)	4 quarters	4 quarters
Vacancy period	2 months	Nil	3 months	Nil

Mr. K Gupta has mortgaged house A for taking Loan lent the amount is fully used for the construction of house B.

(b) Mr. X an employee of ABC Ltd. retired on 30 September, 2018 after completing 25 years 8 months of service. At the time of retirement, his basic salary was ₹ 28,000 p.m., D.A. was ₹ 16,000 p.m. He got a commission of 5% on annual sales of ₹ 6,00,000. He received ₹ 8,00,000 as leave encashment at the time of retirement. His company gives 25 days of leave per year. He took 300 days of leave during his service life. Compute taxable leave salary of Mr. X for the A.Y. 2019-20.

(c) Mr. M, a Japanese citizen left India after a stay of 10 years on 08.07.2016. During the financial year 2017-18, he comes to India for 55 days. Later, he returns to India for 1 year on 22.11.2018. Determine his residential status for the A.Y. 2019-20. 20+10+10=40

8. (a) Mr. P. Basak retired from government service on 30 September, 2018 as director of medical health and services. He started practising as consulting physician from 1 October, 2018. From 1 November, 2018 he also undertook contractual appointment with a private nursing home as superintendent. He furnished the following particulars of his income for the P.Y. ending 31 March, 2019. Compute his taxable income for the A.Y. 2019-20.

Particulars	**Amount (₹)**	**Amount (₹)**
As director of medical service upto 30 September, 2018:		
Basic Pay & D.A.		30,000
Pension per month from October 2018 @ ₹ 1,500		9,000
Leave salary in respect of earned leave at his credit		13,500
Gratuity		1,10,000
Provident Fund		1,50,000
Commuted Pension		32,000
Salary from Nursing Home (5 months)		25,000

Particulars	**Amount (₹)**	**Amount (₹)**
Consultancy Profession:		
Gross consultancy receipts (October 1, 2018 to March 31, 2019)		50,000
Expenditure incurred:		
Salary of staff	12,000	
Rent for premises belonging to his wife	6,000	
Pathological equipment purchased	20,000	
Petrol expenses of the car	5,000	
Donation to Charitable hospital not approved u/s 11 of the I.T. Act		3,000
Further Information:		
Interest on PPF Account		8,000
Interest on Fixed & Savings Bank accounts with Bank		10,000
Dividend on shares with companies		5,000
Interest from US 64 bonds		4,000

The car was acquired on 15 September, 2018 for ₹ 75,000. 20% of the car use is estimated for personal purposes. He made the following investments:

	₹
Kisan Vikas Patra	25,000
N.S.C (VIII issue)	10,000

(b) B. Bagchi (aged 45 years), an employee of XY Co. Ltd. furnishes the following information for the year 2018-19:

Basic Salary	₹ 18,000 p.m.
D.A. (forming part of salary)	₹ 6,000 p.m.
Taxable non-monetary perquisites	₹ 2,30,000
Taxable monetary perquisites	₹ 50,000
Bank interest for FD with SBI	₹ 40,900
Dividend from Indian Company	₹ 22,500

Compute (i) Total Income and (ii) Tax Liability for the relevant A.Y. 25+15=40

9. (a) From the following details of Sri Bose, calculate the amount of deduction u/s 80C for the A.Y. 2019-20.

Investments/Payments made during the F.Y. 2018-19	Amount (₹)
Life insurance premium on own life: Sum assured ₹ 10,00,000 (Due on 28 March, 2019 but paid on 10 April, 2019)	38,000
Life insurance premium on wife's life: Sum assured ₹ 10,00,000 (Due on 8 March, 2019 but paid on 15 March, 2019)	36,000
Life insurance premium on Son's life: Sum assured ₹ 4,00,000 (Due and paid on 5 February, 2019)	82,000

	Amount (₹)
Life insurance premium on mother's life: Sum assured ₹ 10,00,000 (Due on 7 January, 2019 but paid on 10 January, 2019)	48,000
Repayment of principal amount of housing loan to SBI	1,60,000
Investment in NSC (VIII Issue)	30,000
Accrued interest on NSC (Inclusive of last year interest of ₹ 2,305)	7,130
Tuition fees of two children (₹ 18,000 + ₹ 12,000)	30,000

(b) The gross total income of Mr. Ali (a person with disability) for the A.Y. 2019-20 is ₹ 10,00,000 (including interest on savings bank account of ₹ 15,000). He has made the following investments/payments during the P.Y. 2018-19.

	Amount (₹)
Life insurance premium paid (Sum assured ₹ 2,00,000)	50,000
Deposit in Public Provident Fund	40,000
Payment made to LIC pension fund	30,000
Tuition fees paid for son (for school)	36,000
Medical insurance premium paid by cheque for self, wife and son	10,000
Donation to Political Party registered u/s 29A of the Representation of the People Act, 1951	10,000

Compute eligible deductions under chapter VI A for the A.Y. 2019-20.

(c) Following are the particulars of the income of Sri Banerjee for the P.Y. 2018-19.

Particulars	**Amount (₹)**
Income form House Property:	
Property B	22,000
Property J (Loss)	40,000
Profits and Gains of Business:	
A. Non-speculation:	
Business X	50,000
Business Y (Loss)	60,000
B. Speculation:	
Silver	50,000
Bullion (Loss)	20,000
Capital Gains:	
Long term capital gains	35,000
Short term loss	15,000
Income from Other Sources:	
Card games (Loss)	10,000
From the activity of owing & maintaining race horses:	
(i) Loss at Delhi	60,000
(ii) Profit at Kolkata	50,000

Particulars	**Amount (₹)**
Dividend from Indian Companies	1,00,000
Income by letting out Plant & Machinery	1,15,000
The following losses have been carried forward:	
(a) Long -term Capital Loss from the A.Y. 2013-14	18,000
(b) Loss from Silver Speculation from the A.Y. 2013-14; the same was discontinued in the A.Y. 2014-15.	25,000
Compute his gross total income for the A.Y. 2019-20.	12+12+16=40

2021

COMMERCE AND ACCOUNTANCY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and the language.*

Group-A

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

1. (a) Define financial system. What is the significance of the financial system?

   (b) What is the significance of financial intermediary in the financial system?

   (c) Discuss about the structure of Indian financial system. 16+8+16=40

2. (a) What are the financial institutions? Discuss the role played by them in the financial system.

   (b) What are the components of the financial system? 16+16=32

3. (a) Distinguish between organised and unorganised money market.

   (b) Write short notes on repo and reverse repo.

   (c) Discuss the functions of call money market.

   (d) Write notes on recent trends of Indian money market. 10+6+10+6=32

4. (a) "The share market plays an important role in Indian economy"—Discuss.

   (b) What are the functions of the new issue market?

   (c) Explain the relationship between the new issue market and the secondary market. 16+6+10=32

Group-B

Answer *any two* questions.

5. (a) Define offer and acceptance. Explain the various rules regarding offer and acceptance.

   (b) Define consideration. Discuss the rules regarding consideration.

   (c) State the circumstances under which a contract is said to be discharged. 16+10+6=32

6. (a) "An incorporated company is a totally different person or entity from its members — the individuals comprising it"—Explain and illustrate.

   (b) "Memorandum of Association is the fundamental law or charter of a company"—Discuss in details. 16+16=32

7. (a) Write notes on National Commission as mentioned in the Consumer Protection Act, 1986. Discuss the procedure followed by the commission for settlement of dispute.

   (b) Define consumer. What are the objectives of Consumer Protection Act, 1986. 16+16=32

8. (a) What are the dispute settlement authorities under Industrial Dispute Act, 1947, their power and duties.

   (b) Discuss in details about the worker's participation in management and collective bargaining. 16+16=32

Group-C

Answer *any one* question.

9. (a) What are the factors that an auditor should keep in mind before commencement of an audit?

   (b) Write short notes on (i) Internal check system and (ii) Internal control system. 16+16=32

10. (a) What is Divisible Profit of a company? State the statutory provisions relating to the payment of dividend by a company.

    (b) What are non-performing assets of a bank? How will you as an auditor evaluate the internal control system of a bank? 16+16=32

Group-D

Answer *any one* question.

11. (a) Explain the factors that would significantly influence a firm's organisational structure.

    (b) Write notes on modern concepts of organisation theory. 16+16=32

12. (a) Briefly outline the different leadership theories.

    (b) What is Maslow's Need Hierarchy Theory of Motivation? — Explain. 16+16=32

2021

PALI

PAPER–I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Candidates may use ***Devnagari*** *or* ***Roman*** or ***Bengali*** Script in their answers, quotations or expressions in Pali.

Group-A

1. State and illustrate Verner's Law. 12

2. Give some ideas about the linguistic peculiarities of Pali. 20

3. Explain *any three* of the following phonetic tendencies in Pali with suitable examples: 6×3=18

   (a) Dissimilation

   (b) Syncope

   (c) Prothesis

   (d) Lost vowels in Pali

   (e) Treatment of Sanskrit 'Ṛ' in Pali

Group-B

4. What is *Niggahīta*? Why *Niggahīta Sandhi* is so called? Describe different modes of *Niggahīta Sandhi* with suitable examples, in Pali. 18

5. Explain the formation of Causatives in Pali with suitable examples. 12

6. (a) Decline either 'nadī' or 'Tumha' in the Accusative and Instrumental form in both numbers. 4

   (b) Conjugate either $\sqrt{\text{gaha}}$ or $\sqrt{\text{ni}}$ in the Pañcamī. 4

   (c) Make simple sentences using *any three* of the following words in Pali: 4×3=12
   addhā, ambho, antarā, bhiyyo, nissāya, maññe.

Group-C

7. Translate into English *either* of the following verses adding grammatical notes on the underlined words: 10+4=14

   (a) "Svāgataṁ vata me āsi, mama Buddhassa santike,
   Tisso vijjā anuppattā, kataṁ Buddhassa sāsanaṁ."

(b) "Padumuttaro nāma Jino sabbadhammāna pāragū,
Ito satasahassamhi, kappe *uppajji* Nāyako."

8. Translate into English *either* of the prose extracts adding grammatical notes on the words underlined: 10+4=14

(a) "Bhaddekarattassa vo, bhikkhave, uddesañ ca vibhaṅgañ ca desissāmi. Taṁ sunātha manasikarotha, bhāsissamī'ti." "Evam bhante" ti kho te bhikkhū Bhagavato paccassosuṁ".

(b) So ārāmagato parisatiṁ dhammaṁ deseti, na taṁ parisaṁ ussādeti, na tam parisaṁ apasādeti; aññā-d-atthu dhammiyā taṁ parisaṁ sandasseti samuttejoti samādapeti sampahaṁseti."

9. Translate into Pali *either* of the following passages: 22

(a) Cunda was a worker in metals (= kammāra-putta) living in Pava. When the Buddha reached Pava on his way to Kusinara, stayed in Cunda's Mango-grove. There Cunda visited the Buddha and invited him and the monks to a meal next day.

(b) Kassapa Dasabala was the twenty-fourth Buddha, the third of the present aeon (the Bhaddakappa) and one of the seven Buddhas mentioned in the Canon. He was born in Benares, in the Deer Park of Isipatana, of Brahmin parents, Brahmadatta and Dhanavatī belonging in the Kassapagotta.

Group-D

10. Write an essay in Pali on of the following topics: 50

(a) Ariyo Aṭṭhaṅgiko Maggo

(b) Paṭiccasamuppāda

(c) Ācariyo Buddhaghosa

2021

PALI

PAPER–II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Candidates may use ***Devnagari*** *or* ***Roman*** or ***Bengali*** Script in their answers, quotations or expressions in Pali.

Group-A

Answer *Question No. 5* and *any two* from the rest.

1. What is Sattappakaraṇa? Write a note on any one of the 'Pakaraṇas'. 30

2. Write a comprehensive note on the Vaṃsa Literature of Srilanka. 30

3. Briefly describe about the formation of the Bhikkhuṇī Saṅgha adding a note on the 'Aṭṭhagarudhammā'. 30

4. Write a note on the causes of the spread of Buddhism. 30

5. Write short notes on *any four* of the following:— 10×4=40

Khandhaka, Suttanipāta, Visuddhimagga, Ajātasattu, Kusīnārā, Madhyamaka.

Group-B

Attempt all questions. Answers in this group should be in **Pali**.

6. (a) Summarise the content of either the Padhāna Sutta or the gāthā assigned to Kīsāgotamī. 30

(b) (i) Explain with reference to the context— 30

"cattāro janā ẏavamānā na sobhanti''

or

(ii) Write a comprehensive note on King Milinda. 30

7. (a) Write in brief, about the date and authorship of the Subodhālaṃkār. 20

(b) Explain with proper sutta *any two* of the following chandas:— 10×2=20

Cittapadā, Vijjummālā, Vaṃsaṭṭhā, Indavajirā.

2021

SANTALI

Paper - I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer should be given in Santali language and 'olchiki' Script

SECTION – A

1. ᱡᱚᱛᱚ ᱠᱚ ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞᱢᱮ (Answer all the questions) : 10×5=50

ᱚ. ᱯᱟᱹᱨᱥᱤ ᱥᱟᱸᱲᱮᱥ ᱨᱮ ᱨᱚᱱᱚᱲ ᱛᱮᱞᱟ ᱨᱮ ᱚᱠᱟ ᱞᱮᱠᱟ ᱥᱟᱹᱜᱟᱹᱭ ᱢᱮᱱᱟᱜᱼᱟ ? ᱯᱩᱥᱴᱟᱹᱣ ᱛᱮ ᱚᱞᱢᱮ ।

ᱛ. ᱢᱩᱱᱰᱟ ᱯᱟᱹᱨᱥᱤ ᱜᱷᱟᱨᱚᱸᱡᱽ ᱨᱮᱭᱟᱜ ᱡᱟᱹᱴᱤᱧ ᱚᱞᱢᱮ ᱟᱨ ᱚᱱᱟ ᱯᱟᱹᱨᱥᱤ ᱦᱟᱹᱴᱤᱧ ᱠᱚ ᱨᱮᱭᱟᱜ ᱩᱯᱨᱩᱢ ᱚᱞ ᱥᱮᱫᱚᱣ ᱢᱮ ।

ᱜ. ᱨᱚᱱᱚᱲ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜᱼᱟ ? ᱥᱟᱱᱛᱟᱲᱤ ᱯᱟᱹᱨᱥᱤ ᱨᱚᱱᱚᱲ ᱨᱮᱭᱟᱜ ᱦᱟᱨᱟ—ᱵᱩᱨᱩ ᱵᱟᱵᱚᱛ ᱯᱩᱥᱴᱟᱹᱣ ᱛᱮ ᱚᱞ ᱥᱮᱫᱚᱣ ᱢᱮ ।

ᱝ. ᱥᱟᱱᱛᱟᱲᱤ ᱵᱤᱱᱛᱤ (ᱠᱟᱛᱷᱟ) ᱥᱟᱹᱦᱮᱫ ᱫᱚ ᱚᱠᱟ ᱞᱮᱠᱟ ᱥᱟᱱᱛᱟᱲᱤ ᱡᱤᱣᱮᱱ ᱥᱟᱶ ᱡᱚᱲᱟᱣ ᱢᱮᱱᱟᱜᱼᱟ ? ᱥᱟᱞᱟ—ᱜᱟᱴᱟ ᱛᱮᱞᱟ ᱛᱮ ᱚᱞ ᱯᱩᱥᱴᱟᱹᱣ ᱢᱮ ।

ᱞ. ᱥᱟᱱᱛᱟᱲᱤ ᱛᱮ ᱩᱡᱱᱩᱢ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜᱼᱟ ? ᱥᱟᱱᱛᱟᱲᱤ ᱨᱚᱱᱚᱲ ᱨᱮᱭᱟᱜ ᱩᱡᱱᱩᱢ ᱦᱟᱹᱴᱤᱧ ᱯᱟᱹᱨᱛᱩᱞ ᱛᱟᱞᱟ ᱛᱮ ᱚᱞ ᱯᱩᱥᱴᱟᱹᱣ ᱢᱮ ।

2. ᱡᱟᱦᱟᱸᱜᱮ ᱵᱟᱨᱭᱟ (᱒) ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞᱢᱮ (Answer any two) : 25×2=50

ᱚ. ᱯᱟᱹᱨᱥᱤ ᱜᱷᱟᱨᱚᱸᱡᱽ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜᱼᱟ ? ᱯᱟᱹᱨᱥᱤ ᱜᱷᱟᱨᱚᱸᱡᱽ ᱨᱮᱭᱟᱜ ᱦᱟᱹᱴᱤᱧ ᱠᱚ ᱰᱷᱚᱠ ᱛᱟᱞᱟ ᱛᱮ ᱚᱞ ᱥᱮᱫᱚᱣ ᱢᱮ ᱚᱠᱟ ᱜᱷᱟᱨᱚᱸᱡᱽ ᱨᱮ ᱚᱠᱟᱠᱚ ᱟᱨ ᱚᱠᱟᱞᱮᱠᱟᱱ ᱯᱟᱹᱨᱥᱤ ᱠᱚ ᱢᱮᱱᱟᱜᱼᱟ ? ᱯᱩᱥᱴᱟᱹᱣ ᱛᱮ ᱚᱞᱢᱮ ।

ᱛ. ᱯᱟᱹᱨᱥᱤ ᱥᱟᱸᱲᱮᱥ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ ᱠᱟᱱᱟ ? ᱥᱟᱱᱛᱟᱲᱤ ᱯᱟᱹᱨᱥᱤ ᱥᱟᱸᱲᱮᱥ ᱨᱮᱭᱟᱜ ᱦᱟᱨᱟ—ᱵᱩᱨᱩ ᱱᱟᱜᱟᱢ ᱯᱩᱥᱴᱟᱣ ᱛᱮ ᱚᱞ ᱥᱮᱫᱚᱣ ᱢᱮ ।

ᱜ. ᱯᱟᱹᱨᱥᱤ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜᱼᱟ ? ᱨᱚᱲ ᱟᱨ ᱯᱟᱹᱨᱥᱤ ᱛᱮᱞᱟ ᱨᱮᱭᱟᱜ ᱛᱚᱯᱷᱟᱠ ᱚᱞ ᱯᱩᱥᱴᱟᱹᱣ ᱥᱟᱶ ᱥᱟᱱᱛᱟᱲᱤ ᱯᱟᱹᱨᱥᱤ ᱨᱮᱭᱟᱜ ᱵᱤᱥᱮᱥᱚᱛᱟ ᱠᱚ ᱚᱞ ᱥᱮᱫᱚᱣ ᱢᱮ ।

ᱝ. ᱯᱟᱹᱨᱥᱤ ᱨᱮᱭᱟᱜ ᱢᱟᱱᱟᱠ ᱨᱩᱯ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ ᱠᱟᱱᱟ ? ᱥᱟᱱᱛᱟᱲᱤ ᱯᱟᱹᱨᱥᱤ ᱨᱮᱭᱟᱜ ᱢᱟᱱᱠᱤᱠᱚᱨᱚᱱ ᱚᱠᱟ ᱞᱮᱠᱟ ᱛᱮ ᱦᱩᱭ ᱫᱟᱲᱮᱭᱟᱜ-ᱟ ? ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

SECTION – B

3. ᱡᱚᱛᱚ ᱠᱚ ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞᱢᱮ (Answer all the questions) : 10×5=50

ᱚ. ᱥᱟᱱᱛᱟᱲᱤ ᱦᱚᱲ ᱥᱟᱹᱦᱮᱫ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ-ᱟ ? ᱥᱟᱱᱛᱟᱲᱤ ᱦᱚᱲ ᱥᱟᱹᱦᱮᱫ ᱨᱮᱭᱟᱜ ᱦᱟᱹᱴᱤᱧ ᱠᱚ ᱯᱩᱥᱴᱟᱹᱣ ᱛᱮ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱛ. ᱥᱟᱱᱛᱟᱲᱤ ᱦᱚᱲ ᱥᱮᱨᱮᱧ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ-ᱟ ? ᱥᱟᱱᱛᱟᱲᱤ ᱦᱚᱲ ᱥᱮᱨᱮᱧ ᱥᱟᱹᱦᱮᱫ ᱨᱮᱭᱟᱜ ᱦᱟᱹᱴᱤᱧ ᱠᱚ ᱯᱩᱥᱴᱟᱣ ᱛᱮ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱜ. ᱢᱮᱺᱡᱷᱤ ᱨᱟᱢᱫᱟᱥ ᱴᱩᱰᱩ 'ᱨᱟᱹᱥᱠᱟᱹ' ᱟᱜ ᱡᱤᱭᱚᱱ ᱟᱨ ᱥᱟᱹᱦᱮᱫ ᱠᱟᱹᱨᱫᱷᱟᱹᱱᱤ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱝ. ᱥᱟᱨᱚᱫᱟ ᱯᱨᱚᱥᱟᱫ ᱠᱤᱥᱠᱩ ᱟᱜ ᱡᱤᱭᱚᱱ ᱟᱨ ᱥᱟᱹᱦᱮᱫ ᱠᱟᱹᱨᱫᱷᱟᱹᱱᱤ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱞ. ᱥᱟᱱᱛᱟᱲᱤ ᱠᱷᱚᱱᱰᱚ ᱠᱟᱹᱵᱭᱚ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ-ᱟ ? ᱵᱟᱥᱩᱫᱮᱵ ᱵᱮᱥᱨᱟ ᱚᱞᱟᱜ 'ᱵᱤᱵᱨᱟᱹᱣ' ᱠᱷᱚᱱᱰᱚ ᱠᱟᱹᱵᱭᱚ ᱨᱮᱭᱟᱜ ᱥᱟᱨ ᱠᱟᱛᱷᱟ ᱠᱷᱟᱴᱚ ᱛᱮ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

4. ᱡᱟᱦᱟᱸᱜᱮ ᱵᱟᱨᱭᱟ (᱒) ᱠᱩᱠᱞᱤ ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱚᱞᱢᱮ (Answer any two) : 25×2=50

ᱚ. ᱥᱟᱱᱛᱟᱲᱤ ᱠᱟᱹᱛᱷᱮᱤ (ᱜᱚᱫᱷᱭᱚ) ᱥᱟᱹᱦᱮᱫ ᱨᱮᱭᱟᱜ ᱦᱟᱹᱴᱤᱧ ᱟᱨ ᱦᱟᱨᱟ–ᱵᱩᱨᱩ ᱯᱟᱲᱦᱟᱣ ᱛᱮ ᱚᱞ ᱢᱮ ।

ᱛ. ᱥᱟᱱᱛᱟᱲᱤ ᱵᱤᱱᱛᱤ ᱫᱚ ᱚᱠᱟ ᱠᱚ ᱢᱮᱛᱟᱜ ᱠᱟᱱᱟ ? ᱡᱚᱢᱥᱤᱢ ᱵᱤᱱᱛᱤ ᱨᱮᱭᱟᱜ ᱵᱤᱥᱚᱭ– ᱵᱚᱥᱛᱩ ᱯᱟᱲᱦᱟᱣ ᱛᱮ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱜ. ᱜᱩᱨᱩ ᱜᱚᱢᱠᱮ ᱨᱟᱜᱷᱩᱱᱟᱛᱷ ᱢᱩᱨᱢᱩ ᱟᱜ ᱥᱟᱹᱦᱮᱫ ᱠᱟᱹᱨᱫᱷᱟᱹᱱᱤ ᱯᱟᱲᱦᱟᱣ ᱛᱮ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱝ. ᱥᱟᱱᱛᱟᱲᱤ ᱛᱟᱞᱟ ᱡᱩᱜ ᱨᱮᱭᱟᱜ ᱥᱟᱹᱦᱮᱫ ᱦᱟᱨᱟ–ᱵᱩᱨᱩ ᱥᱟᱶ ᱵᱤᱥᱚᱭᱵᱚᱥᱛᱩ ᱯᱟᱲᱦᱟᱣ ᱛᱮ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

2021

SANTALI

Paper - II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer should be in OLCHIKI *Script*

ᱡᱟᱦᱟᱸᱜᱮ ᱯᱷᱮᱭᱟ. (᱔) ᱠᱩᱠᱞᱤ ᱨᱮᱱᱟᱜ ᱛᱮᱞᱟ ᱚᱞ ᱢᱮ । No- (᱑) ᱟᱨ (᱔) ᱨᱮᱭᱟᱜ ᱛᱮᱞᱟ ᱮᱢ ᱫᱚ ᱡᱟᱹᱨᱩᱲ ᱜᱮᱭᱟ ।

SECTION – A

1. ᱞᱟᱛᱟᱨ ᱨᱮ ᱮᱢ ᱟᱠᱟᱱ ᱠᱩᱠᱞᱤ ᱠᱚ ᱨᱮᱱᱟᱜ ᱛᱮᱞᱟ ᱫᱚ ᱠᱷᱟᱴᱚᱜᱚᱜ ᱠᱟᱱ ᱞᱮᱠᱟᱛᱮ ᱢᱤᱫᱴᱟᱹᱝ ᱢᱚᱬᱮ ᱜᱮᱞ (᱑᱕᱐) ᱟᱹᱲᱟᱹ ᱟᱛᱮ ᱚᱞ ᱢᱮ । 10×5=50

ᱚ. ᱠᱟᱨᱟᱢ ᱵᱤᱱᱫᱤ ᱫᱚ ᱪᱮᱫᱟᱜ ᱠᱚ ᱵᱤᱱᱛᱤᱭᱟ ? ᱠᱟᱨᱟᱢ ᱵᱤᱱᱛᱤ ᱨᱮᱱᱟᱜ ᱯᱷᱮᱵᱟᱛ ᱠᱟᱛᱷᱟ ᱚᱞ ᱢᱮ ।

ᱛ. ᱱᱟᱭᱠᱮ ᱢᱚᱸᱜᱚᱞ ᱯᱚᱱᱫᱨᱚ ᱥᱚᱝᱮᱱ ᱵᱟᱵᱚᱛ ᱡᱟᱦᱟᱢ ᱵᱟᱵᱟᱜ ᱚᱞ ᱢᱮ ।

ᱜ. ᱵᱤᱫᱩ ᱪᱟᱸᱫᱟᱱ ᱜᱟᱨᱟᱱ ᱠᱷᱚᱱ ᱪᱟᱸᱫᱟᱱ ᱟᱜ ᱪᱚᱨᱤᱛ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

ᱝ. ᱡᱟᱹᱛᱤ ᱢᱤᱞᱟ ᱚᱱᱚᱲᱦᱮᱸ ᱫᱚ ᱚᱠᱚᱭ ᱫᱚ ᱚᱠᱚᱭᱮ ᱚᱞᱟᱠᱟᱫᱟ ? ᱚᱱᱟ ᱚᱱᱚᱲᱦᱮᱸ ᱛᱟᱞᱟ ᱛᱮ ᱪᱮᱫ ᱢᱮᱱᱚᱜᱚᱜ ᱠᱟᱱᱟ ᱯᱩᱥᱴᱟᱹᱣ ᱛᱮ ᱚᱞ ᱢᱮ ।

ᱞ. ‘ᱚᱱᱟ ᱛᱮᱲᱚᱣ ᱦᱚᱲ ᱠᱚ ᱫᱷᱚᱨᱟᱹ. ᱠᱟᱱᱟ ᱦᱚ’ ᱱᱚᱣᱟ ᱫᱚ ᱪᱮᱫ ᱥᱮᱨᱮᱧ ᱠᱟᱱᱟ ? ᱪᱮᱫᱟᱜ ᱠᱚ ᱫᱷᱚᱨᱟᱹ.ᱣ ᱮᱫ ᱵᱚᱱᱟ ᱡᱚᱛᱚᱨᱚᱛ ᱥᱟᱹᱦᱤᱡ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ ।

᱒.

ᱚ. ᱥᱤᱫᱩ, ᱠᱟᱱᱦᱩ, ᱪᱟᱸᱫ, ᱵᱷᱟᱭᱨᱚᱵ, ᱫᱚ ᱚᱠᱚᱭ ᱠᱚ ᱠᱟᱱᱟᱠᱚ ? ᱦᱩᱞ-ᱟ ᱫᱤᱥᱚᱢᱹᱥᱤᱭᱟᱹ ᱠᱟᱹᱢᱤ ᱚᱞ ᱥᱚᱫᱚᱨ ᱢᱮ । 25

ᱛ. ᱥᱟᱱᱛᱟᱲᱤ ᱜᱟᱹᱭᱟᱱ ᱥᱟᱹᱦᱤᱛ ᱞᱟᱦᱟᱱᱛᱤ ᱨᱮᱱᱟᱜ ᱪᱟᱱᱛᱚᱨ ᱠᱚ ᱚᱞ ᱢᱮ । 25

ᱵᱟᱝᱠᱷᱟᱱ/OR

᱓.

ᱚ. ‘ᱠᱷᱮᱨᱣᱟᱞ ᱵᱚᱝᱥᱚ ᱫᱷᱚᱨᱚᱢ ᱯᱩᱛᱷᱤ’ ᱨᱮ ᱪᱮᱫ ᱠᱚ ᱚᱞ ᱟᱠᱟᱫᱟ ᱚᱞ ᱯᱩᱥᱴᱟᱹᱣ ᱢᱮ । 25

O. 'ଏହା ବର୍ତ୍ତମାନ ଯୁଗରେ ଏକାଡ଼ମିକ ବି ଜୀବନରେ ବଳିଷ୍ଠତା' ପ୍ରସଙ୍ଗରେ ଆପଣ ମତାମତ ଦେଇଥିବା ଦୃଷ୍ଟିକୋଣ ଆଲୋଚନା କରିବା ଆବଶ୍ୟକ । 25

SECTION – B

G. 10×5=50

H. 'ଭାରତୀୟ ଗ୍ରେ ହାଉଣ୍ଡ୍ସ' କେଉଁଠାରେ ଅବସ୍ଥିତ ହୋଇଛି ? ଏହାର ପ୍ରତିଷ୍ଠାତା କିଏ ଥିଲେ ।

O. 'ହାଇଦ୍ରୋଜେନ ଏୟାର ବଲୁନ' କିପରି ପ୍ରସ୍ତୁତ ହୋଇଥାଏ ? ଏହାର ଦୁଇଟି ବ୍ୟବହାର ଲେଖ ।

G. ହାଇଡ୍ରୋଜେନ ପରମାଣୁର 'ଏୟାମ' ଏବଂ ପ୍ରତ୍ୟେକ ଶକ୍ତି ସ୍ତରରେ କେତୋଟି ଇଲେକ୍ଟ୍ରନ ରହିଥାଏ ।

I. ହାଇଡ୍ରୋଜେନ ଗ୍ୟାସ ଜଳିବାକୁ ଅମ୍ଳଜାନ ଆବଶ୍ୟକ କି ? ଆପଣଙ୍କ ଉତ୍ତର ସପକ୍ଷରେ ଯୁକ୍ତି ଦିଅ ।

P. ହାଇଡ୍ରୋଜେନ ଏକାଧିକ ଉପାଦାନ ସହିତ ରାସାୟନିକ ହାଇଡ୍ରାଇଡ୍ ଯୌଗିକ ତିଆରି କରିଥାଏ । ଯେ କୌଣସି ଦୁଇଟି ଲେଖ ।

Q.

R. 'ହାଇଡ୍ରୋଜେନ ଉତ୍ପାଦନ' ପ୍ରସଙ୍ଗରେ ଏହା କିପରି ପ୍ରସଙ୍ଗ ହୋଇଥାଏ ? ଏହା ପ୍ରସଙ୍ଗରେ କେଉଁ କେଉଁ ବିଷୟ ଆଲୋଚନା କରାଯାଇଥାଏ ? ଆପଣଙ୍କ ମତାମତ ଯୁକ୍ତି ସହିତ ଲେଖ । 25

O. ଏହା ହାଇଡ୍ରୋଜେନ ପ୍ରସଙ୍ଗରେ କିପରି ଗୁରୁତ୍ୱପୂର୍ଣ୍ଣ ଏବଂ ଏହାର ଭବିଷ୍ୟତ ସମ୍ଭାବନା ସମ୍ପର୍କରେ ଆପଣଙ୍କ ମତାମତ ଦିଅ । 25

ଅଥବା/OR

S.

R. ହାଇଡ୍ରୋଜେନର ଫିଜିକାଲ ପ୍ରପର୍ଟିଜ ସମ୍ପର୍କରେ ହାଇଡ୍ରୋଜେନର ବ୍ୟବହାର ଲେଖ । 25

O. 'ସୋଡ଼ିୟମ୍ କ୍ଲୋରାଇଡ୍' କେଉଁଠାରେ କେଉଁପରି ପରିସ୍ଥିତିରେ ଅଛି ? ଏହାର ଦୁଇଟି ବ୍ୟବହାର ଲେଖ ଏବଂ ଏହାର ଗଠନ ବର୍ଣ୍ଣନା କର । 25

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3. The Qur'an was revealed by Allah to the Prophet Mohammed verse by verse by the angel Gabriel. It was then compiled by the third Caliph Uthman Radi ALLAHu Ta'ala 'Anhu into the version still in use to this day, which has been memorized cover to cover by hundreds of thousands of Muslims.

   The Quran tells that the believers have been sent for the betterment of mankind, that they will promote what is good, and prevent what is wrong. However, this is to be carried out in the best possible manner: no individuals honor should be injured, and no harm should arise out of it.

Section – E

25 أجب عن أي واحد من الأسئلة التالية:

1. عرّف الاستعارة مع بيان أقسامها بالتفاصيل.
2. ماذا تعرف عن علم المعاني؟ اكتب مفصلا.

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2. وُلِدَ خاتم الرُّسل محمد -عليه الصلاة والسلام- يوم الاثنين من شهر ربيع الأوّل من عام الفيل، وقد رأت أمّه حين ولادته كأنّ نوراً يخرج منها تُضيء له قصور الشام، وقد نشأ النبيّ -عليه الصلاة والسلام- في قومه يتيماً دون أب؛ أرضعته مُبكِّراً مَولاة أبي لهب، وتُدعى ثويبة، ثمّ أخذته أمّه إلى ديار بني سعد؛ التماسَ مُرضعةً له من الأعراب؛ فأرضعته هناك السيّدة حليمة السعديّة، وبقيَ عندها زماناً، وحصلت له في تلك الديار حادثة شَقّ الصَّدر؛ حين أتاه جبريل -عليه السلام-، فشَقّ عن صَدره، وأخرج قلبه، فشَقَّه نصفَين، ثمّ أخرج منه قطعةً سوداء؛ وهي حَظّ الشيطان منه، ثمّ غسلَ القلب بماء زمزم، ثمّ لَأَمَ قلبه، وأعاده إلى مكانه، ثمّ أعادته مُرضعته إلى أهله.

3. القِيم الإنسانية هي تلك المبادئ والعادات والأخلاقيّات التي نستخدمها، ونستعملها في حياتنا باستمرار، ومن وجهة نظر علم الفلسفة أنّ القيم هي تلك الجزئيّة من أخلاقيّات الإنسان وغاياته، التي يسعى إليها سواء لغايات يطلبها الإنسان في داخله، أو متطلّبات ذاتيّة له، إذن فالقيم هي مجموعة الأحكام التي تصدر من العقل، وتوجّه الإنسان نحو رغباته، واتّجاهاته المكتسبة من المجتمع الذي يعيش فيه، والتي تعمل على تحريك سلوكيّاته، فهو بناء يبدأ داخل الإنسان، ويعزّز وينمو من خلال الحياة وتجاربه التي يمر فيها.

Section – D

ترجم أي اثنين من الفقرات التالية من الإنجليزية إلى العربية: 25×2 = 50

1. The much-awaited assembly elections in West Bengal will be held over eight rounds from March 27–April 29 for 294 seats. In the politically charged state, the ruling Trinamool Congress Party (TMC) and PM Modi-led Bharatiya Janata Party (BJP) are locked in a bitter contest this time. The TMC headed by two-time Chief Minister Mamata Banerjee is striving hard to score a hat-trick. The BJP is also leaving no stone unturned to make sure Lotus blooms in the state. The third front has the CPI-M and Congress entering into a seat-sharing arrangement, and this combine is also trying to align with the ISF.

2. Historical records bear ample testimony to the fact that Sayyidah Ayesha Radi ALLAHu Ta'ala Anha was a precocious genius and was developing both in mind and body with rapidity peculiar to such rare personalities. This marriage is significant in the history of Islam in so many aspects. Firstly, it cemented the ties between Sayyiduna Rasoolullah Peace Be Upon Him and his devoted friend Hazarat Abu Bakr Siddique Radi ALLAHu Ta'ala 'Anhu who always stood by him in hour of trial and who sacrificed his all for the cause of Islam. Secondly, all the wives of the Holy Prophet PBUH with the exception of Ayesha (R) were of advanced age. The only lady with whom young women could frankly enter into conversation and discuss problems without any reserve could be none but Sayyidah Ayesha Radi ALLAHu Ta'ala 'Anha.

2021

ARABIC

PAPER – I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figure in the margin indicate marks for each question.

Section – A

25

أجب عن أي واحد من الأسئلة التالية:

1. ناقش علم الأصوات العام وعلم الأصوات الوظيفي.
2. ما هو علم اللسانيات؟ ألق الضوء على جميع جوانبه.

Section – B

25×2 = 50

أجب عن أي اثنين من الأسئلة التالية:

1. ناقش المفاعيل الخمسة.
2. اكتب ملاحظة حول الممنوعة من الصرف.
3. ماذا تعرف عن الحال وذي الحال؟ بيّن بالتفاصيل.

Section – C

25×2 = 50

ترجم أي اثنين من الفقرات التالية من العربية إلى الإنجليزية:

1. فيروسات كورونا هي مجموعة من الفيروسات التي يمكنها أن تسبب أمراضًا مثل الزكام والالتهاب التنفسي الحاد الوخيم . تم اكتشاف نوع جديد من فيروسات كورونا بعد أن تم التعرف عليه كمسبب لانتشار أحد الأمراض التي بدأت في الصين في 2019. يُعرف الفيروس الآن باسم فيروس المتلازمة التنفسية الحادة الوخيمة كورونا 2. ويسمى المرض الناتج عنه مرض فيروس كورونا 2019 (كوفيد 19). في مارس/آذار 2020، أعلنت منظمة الصحة العالمية أنها صنفت مرض فيروس كورونا 2019 (كوفيد 19) كجائحة. وتقوم المجموعات المختصة بالصحة العامة، مثل مراكز مكافحة الأمراض والوقاية منها في الولايات المتحدة ومنظمة الصحة العالمية، بمراقبة الجائحة ونشر التحديثات على مواقعها على الإنترنت. كما أصدرت هذه المجموعات توصيات حول الوقاية من المرض وعلاجه.

3. اشرح العبارة مع ذكر السياق والسباق: 15

قَالَ ابْنُ إِسْحَاقَ : وَكَانَ رَبِيعَةُ بْنُ نَصْرٍ مَلِكُ الْيَمَنِ بَيْنَ أَضْعَافِ مُلُوكِ التَّبَابِعَةِ فَرَأَى رُؤْيَا هَالَتْهُ وَفَظِعَ بِهَا فَلَمْ يَدَعْ كَاهِنًا ، وَلَا سَاحِرًا ، وَلَا عَائِفًا وَلَا مُنَجِّمًا مِنْ أَهْلِ مَمْلَكَتِهِ إِلّا جَمَعَهُ إِلَيْهِ فَقَالَ لَهُمْ إِنِّي قَدْ رَأَيْت رُؤْيَا هَالَتْنِي ، وَفَظِعْتُ بِهَا ، فَأَخْبِرُونِي بِهَا وَبِتَأْوِيلِهَا ، قَالُوا لَهُ أُقْصُصْهَا عَلَيْنَا نُخْبِرْك بِتَأْوِيلِهَا ، قَالَ إِنِّي إِنْ أَخْبَرْتُكُمْ بِهَا لَمْ أَطْمَئِنّ إِلَى خَبَرِكُمْ عَنْ تَأْوِيلِهَا ، فَإِنَّهُ لَا يَعْرِفُ تَأْوِيلَهَا إِلّا مَنْ عَرَفَهَا قَبْلَ أَنْ أُخْبِرَهُ بِهَا . فَقَالَ لَهُ رَجُلٌ مِنْهُمْ فَإِنْ كَانَ الْمَلِكُ يُرِيدُ هَذَا فَلْيَبْعَثْ إِلَى سَطِيحٍ وَشِقّ فَإِنَّهُ لَيْسَ أَحَدٌ أَعْلَمَ مِنْهُمَا ، فَهُمَا يُخْبِرَانِهِ بِمَا سَأَلَ عَنْهُ .

4. شكّل العبارة مع بيان مصدر هذه الفقرة: 15

والتحدي هو الفارق بينها وبين الكرامة والسحر، إذ لا حاجة فيهما إلى التصديق، فلا وجود للتحدي إلا إن وجد اتفاقاً. وإن وقع التحدي في الكرامة عند من يجيزها وكانت لها دلالة فإنما هي على الولاية وهي غير النبوة. ومن هنا منع الأستاذ أبو إسحق وغيره وقوع الخوارق كرامة فراراً من الالتباس بالنبوة عند التحدي بالولاية. وقد أريناك المغايرة بينهما وأنه يتحى بغير مايتحدى به النبي، فلا لبس، على أن النقل عن الأستاذ في ذلك ليس صريحاً، وربما حمل على إنكار أن تقع خوارق الأنبياء لهم بناء على اختصاص كل من الفريقين بخوارقه. وأما المعتزلة فالمانع من وقوع الكرامة عندهم أن الخوارق ليست من أفعال العباد وأفعالهم معتادة، فلا فرق.

Section – B

1. بيّن معنى الكلمات التي تحتها خط: 10

فإن ذُكِرَتْ في الحَيّ أصبحَ أهلُهُ	نَشاوى ولا عارٌ عليهمْ ولا إثم
ومِنْ بينِ أحشاء الدّنانِ تصاعدتْ	ولم يَبْقَ منها في الحقيقة إلاّ اسمُ
وإن خَطَرَتْ يوماً على خاطرِ امرىءٍ	أقامتْ به الأفراحُ وارتحلَ الهمّ
ولو نَظَرَ النُّدْمَانُ خَتمَ إنائِها	لأسكَرَهُمْ من دونِها ذلكَ الختم
ولو نَضحوا منها ثرَى قبرِ مَيّتٍ	لعادتْ اليه الرّوحُ وانتَعَشَ الجسم
ولو طَرَحُوا في فَيءِ حائطِ كَرْمِها	عليلاً وقد أشفى لفَارَقَهُ السّقم

2. من أي معلقة تم أخذت هذه الأبيات؟ وماذا ناقش الشاعر في هذه الأبيات؟ 10

ومن يجعلِ المعروفَ من دونِ عِرضه	يَفِرْه ومن لا يتّقي الشّتم يُشتَمِ
لسانُ الفَتَى نصفٌ ونصفٌ فؤاده	فلم يبقَ إلاّ صورةُ اللّحمِ والدّمِ
وكائنْ تَرَى من صامت لكَ معجب	زيادتهُ أو نقصُهُ في التّكلّمِ
وأعلمُ ما في اليومِ والأمسِ قبلَهُ	ولكنّني عن علمِ ما في غدٍ عَمِي
ومن يَكُ ذا فضلٍ فَيَبخلْ بفضلِهِ	علَى قومِهِ يُستغنَ عنهُ ويُذمَمِ
ومَن لمْ يزلْ يستحملُ النّاسَ نفسَهُ	ولا يُغْنِها يوماً من الدّهر يُسْأمِ

2021

ARABIC

PAPER – II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figure in the margin indicate marks for each question.

Section – A

العصر الجاهلي

أجب عن أي خمسة من الأسئلة التالية:

30×5 = 150

1. . اكتب ملاحظة قيّمة حول المعقات السبع.

2. ناقش أثر القرآن الكريم على النثر العربي في العصر الإسلامي.

3. ألق الضوء على تطور الشعر النقائض بالتفاصيل.

4. بيّن إسهامات الرابطة القلمية في تطوير الأدب العربي في المهجر.

5. ناقش مساهمة نجيب محفوظ في الرواية العربية.

6. اكتب ملاحظة حول تطور النثر العربي في العصر الحديث.

7. من كان شاعر النيل ؟ بيّن حياته وخدماته في الشعر العربي.

8. ناقش تطور الأدب العربي في بلاد المغرب العربي.

2021

AGRICULTURE

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) What do you mean by physical features and climate? 10

   (b) Discuss in short crop yield formulation. 10

   (c) Write in short long range forecasts of weather and crop yields. 10

   (d) Write down the agro-climatic zones in India. 10

2. (a) What do you mean by cropping pattern? 10

   (b) Discuss in brief the present cropping patterns. 10

   (c) Write down the rice based cropping in West Bengal. 10

   (d) Discuss about Mixed cropping in India. 10

3. (a) What do you mean by fibre crops? Write down the names of fibre crops cultivated in India. Write down the cultivation of improved methods jute cultivation. What are the problems faced by the farmers for jute retting? 20

   (b) Describe different methods cultivation of improved yield varieties of rice by farmers of West Bengal. 20

4. (a) Describe in brief the natural powers of weeds. 10

   (b) Discuss in details types of weeds found in the field. 15

   (c) Describe in brief crop-weed competition. 15

5. (a) Define soil. 5

   (b) Describe the process and factors of soil formation. 20

   (c) Discuss in details problems of soil. 15

Group-B

Answer *any two* questions.

6. (a) Critically discuss about plant nutrition and soil plant system. 20

   (b) Discuss plant nutrients and their function. 20

7. (a) Critically discuss in details importance and role of Agriculture-extension for rural development. 20

   (b) Discuss role of Krishi Vigyan Kendra in transfer of technology. 20

8. (a) Critically discuss functions of agricultural marketing. 20

   (b) Critically discuss the marketing improvements for getting proper market price of the farmers. 20

2021

AGRICULTURE

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be given either in **English** *or in* **Bengali** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) What do you mean by 'good quality seed'? 5

   (b) Describe the seed production technology of rice. 20

   (c) Write down the normal seed certification procedure. 15

2. (a) State Mendel's laws of heredity. 10

   (b) What do you mean by polyploidy? 5

   (c) Discuss in details about polyploids in agriculture. 25

3. (a) Distinguish between plant growth and development. 5

   (b) Discuss on plant growth factors and their roles. 10

   (c) Define plant growth regulator (PGR). Give the classification of PGR. Mention the uses of Auxin, Gibberellins and Ethylene in agriculture. 25

4. Write in brief on *any two*: 20×2=40

   (a) Cultivation of betelvine crop under closed system (within *boroj*)

   (b) IPM for vegetable crops

   (c) Cultivation of tea in West Bengal

   (d) Recommended cultivation practices of *marigold*

5. Write in details about the cultivation practices of *Mango* and *Guava* with special reference to: soil, land preparation, sowing parameters, varieties, intercultural operations, nutrient management, plant protection measures, harvesting and yield. 20+20=40

Group-B

Answer *any two* questions.

6. Write short notes on *any five*: 8×5=40

   (a) Mutation breeding in plants

   (b) Plant cell structure and functions

   (c) GM crops

   (d) Role of light as a biological agent

   (e) Export of agricultural commodities

   (f) Role of osmosis in plant life

   (g) Important medicinal plants of West Bengal and their uses

   (h) Uses of spices and condiments

7. (a) Compare C_3, C_4 and CAM plants. 12

   (b) Classify environmental stresses to which plants may be subjected during their growth periods. 8

   (c) Describe the effects of water deficit on growth and metabolism of plants. 20

8. (a) What is landscaping? Describe the process and steps of landscaping. 20

   (b) Discuss on protected cultivation of horticultural crops. 20

9. Write in brief on *any four*: 10×4=40

   (a) Critical day length

   (b) Antitranspirants

   (c) Hill reaction

   (d) Storage of crop seeds

   (e) Plant respiration

   (f) Nutritional security

   (g) Plant propagation

2021

CHEMISTRY

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

The figures in the margin indicate full marks for each question.

Answers may be written either in ***English*** *or in* ***Bengali*** *but all answers must be in one and the same language.*

Section-I

This Section comprises 15 questions in three Groups.

Answer *any ten* questions taking *at least three* questions from each Group.

Group-A

1. An electron in a hydrogen atom in its ground state absorbs 1.50 times as much energy as the minimum required for it to escape from the atom. Calculate the wavelength of the emitted electron. (Given ionisation energy of H–atom = 13·6 eV. $m_e = 9{\cdot}109 \times 10^{-31}$ kg, $h = 6{\cdot}63 \times 10^{-34}$ JS). 4

2. Predict the species among SF_4, I_3^-, $SbCl_6^-$ and PCl_5 in which the central atom has used different type of hybridisation for chemical bonding from the others. 4

3. Aqueous solution of borax function as buffer solution of pH 9·18— why? 4

4. Using Pauling's rules, explain the pk_{a_1} -values of H_3PO_3 (~2·0) and H_3AsO_3 (~9·0) with respect to their structural difference, if any. 4

5. Establish Nernst equation for the couple VO_3^-/VO^{2+} standard potential of this couple at 25°C in 1(M) acid medium is + 0·92 volt. Find the formal potential at pH = 7·0. 4

Group-B

6. For an ideal gas show that the word done for a reversible adiabetic expansion is $W_{ad} = C_v \Delta T$. 4

7. What is mean free path? How does it depend on the size of gas molecules? 4

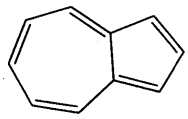
8. Write van der Waals equation for real gases. Derive a and b in terms of the critical parameters V_c, T_c and P_c. 4

9. What is atomic packing factor? Calculate that for a body centered cubic crystal structure. 4

10. Define Joule-Thompson coefficient. It is an intensive property. Justify your answer. 4

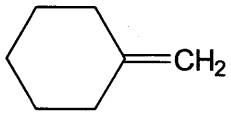
Group-C

11. Azulene ($C_{10}H_8$) is a deep-blue compound having dipole moment (1.0 D).—Explain. 4



12. The room temperature ^1H NMR spectrum thiophene-3-carboxamide ($C_4H_3SCONH_2$) contains five signals. Give a reason for this observation. 4

13. Which alkyl bromide and what conditions would be used to prepare the following alkene in good yield by E2 elimination? Justify your choice. 4



14. (S)-1-bromo-1-fluoroethane reacts with CH_3ONa in ethanol to give pure (S)-1-fluoro-1-methoxyethane. Is this result consistent with reaction by S_N2 mechanism? Explain. 4

15. Draw a reaction free-energy diagram for a reaction $A \rightleftharpoons B \rightleftharpoons C$ that meets the following criteria. The starting free energy are in the order C<A<B, and the rate limiting step of the reaction is $A \rightleftharpoons B$. 4

Section-II

This Section comprises *six* questions in three Groups. Answer *any four* questions taking *at least one* question from each Group.

Group-A

1. (a) An electron circles a nucleus of charge 'Ze'. Of the two orbits 1 and 2 of radii r_1 and r_2 respectively, its total energy is greater while in orbit-1. Prove that $r_1 > r_2$. Also show that the velocity and acceleration in orbit-2 are higher than those in orbit-1. 8

   (b) State the Heisenberg uncertainty principle. Suppose an electron is confined within the nucleus of diameter 10^{-14} metre. Find the uncertainty in determination of its velocity. Hence show that an electron can never reside inside the nucleus. 8

   (c) Write down the Born-Lande equation and explain the significance of the terms present. 2+4=6

   (d) Calculate the value of lattice energy of NaCl using the given data: A = 1·74, r_0 = 2·79Å, n = 8. 6

(e) Can you develop a pH-like scale in liquid NH_3? Given: $K_{H_2O} = 10^{-14}$ at 298K, $K_{NH_3} = 10^{-33}$ at 223K. 4

(f) Explain the basis of Mulliken electronegativity scale. 4

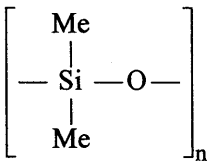
(g) Calculate the Pauling electronegativity value of fluorine from the following data (kcal/mole): D_{H-H}=104·2, D_{F-F}=36·6 and D_{H-F}=135·6. 4

2. (a) Consider the ethers $H_3SiOSiH_3$ and H_3COCH_3.

(i) Which ether has more Lewis base character and why?

(ii) Which angle $\left[\text{Si}-\hat{\text{O}}-\text{Si and C}-\hat{\text{O}}-\text{C}\right]$ is greater and why? 3+3=6

(b) Starting from SiO_2, show how the following polymer is prepared industrially. 4



(c) (i) Al_2Cl_6 and Al_2Me_6 are dimeric in gas phase. Draw their structures. Which compound is more Lewis acid character? Explain.

(ii) Arrange the halides $SnCl_2$, $PbCl_2$, $SiCl_2$ in the increasing order of their stability and explain your arrangement. 6+6=12

(d) What is formal potential of a redox couple? Give its an analytical importance. 8

(e) Calculate the pH of a solution made by mixing 50ml of 0·10M NH_3 and 50ml 0·040M HCl. The K_b of $NH_3 = 1{\cdot}8\times10^{-5}$ at 298K. 6

(f) Arrange the following: (i) Acidic nature: Ag_2O, V_2O_5, N_2O_5 (ii) Stronger base towards a proton: NH_2^-, PH_2^- 2+2=4

Group-B

3. (a) Define thermal expansivity (α) and isothermal compressibility (β) for an ideal gas. Verify that $\left(\partial P/\partial T\right)_{V_m} = \alpha/\beta$ where V_m is the molar volume. 9

(b) What is mean-square speed? For 1·00 mol of $CH_4(g)$ at 0°C and 1 atm, find the number of molecules whose speed lies in the range 90·000 m/s to 90·002 m/s. 6

(c) What is Bragg's law? Explain with a suitable diagram. For a given wavelength of X-rays what is the lower limit of the spacings that can give observable diffraction?

For X-rays with X 3·0Å, what angles of incidence produce a diffracted beam from the (100) planes in a simple cubic lattice with side 5·0Å? 12

(d) A cylinder is fitted with a frictionless piston containing 3·00 mol of He gas at 1atm pressure and is in a large constant temperature bath at 400K. The pressure is reversibly increased to 5·00 atm. Find w, q and ΔU for this process. 6

(e) Derive Laplace equation $p_{in} = p_{out} + {}^{2\gamma}/_{r}$ for curved surfaces where the terms have their usual meaning.

Calculate the pressure difference across the surface of an ethanol droplet of radius 220 nm at 20°C. The surface tension of ethanol at 20°C is 22·39 mNm^{-1}. 7

4. (a) Define heat capacity at constant volume. Show that $q_v = C_v dT$ where q_v is the heat supplied at constant volume. What does a large heat capacity imply?

What will be the heat capacity at a phase transition, such as boiling point of water? Explain your answer. 8

(b) Calculate the change in entropy when the pressure of a fixed amount of perfect gas is changed isothermally from P_i to P_f. What is this change due to? 5

(c) Using the relation $\left({}^{\partial S}/_{\partial V}\right)_T = \left({}^{\partial P}/_{\partial T}\right)_V$ show that the entropy of a perfect gas is $l_n V$. 4

(d) State Nernst heat theorem.

Calculate the entropy of transition between orthorhombic sulfur (α) and monoclinic sulfur (β) at 369K $\left[Given: S_m(\beta) - S_m(\alpha) = -\ 402\,Jmol^{-1}\right]$. 4

(e) Show that $d\ln k / d\left({}^{1}/_{T}\right) = {}^{-\Delta H^\circ}/_{R}$. 4

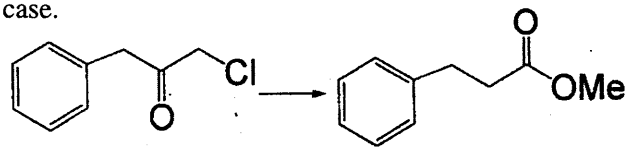
(f) For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ establish a relationship between K and K_c. 6

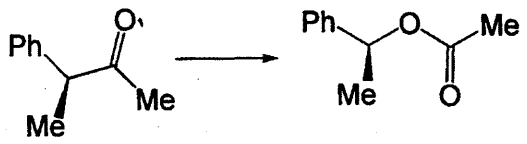
(g) What are Miller indeces? How are they obtained? For a simple cubic lattice draw the (100) and (111) planes. 6

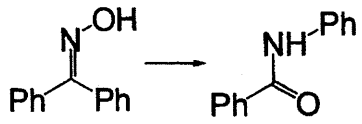
(h) What are point defects in solids? Give two examples. 3

Group-C

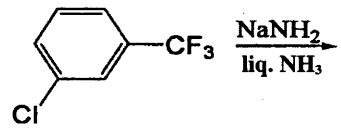
5. (a) Show how you would carry out the following conversions. Give reasonable mechanism in each case. 4×3=12

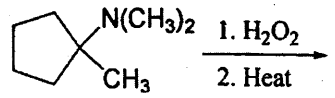
(i) 

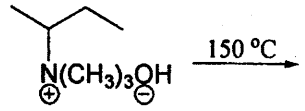
(ii) 

(iii) 

(b) Predict the major product formed in each of the following reaction. Propose plausible mechanism that account for the formation of each product: 5+3+3=11

(i) 

(ii) 

(iii) 

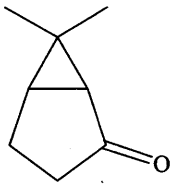
(c) An unknown compound (C_3H_2NCl) shows moderately strong IR absorptions around 1650 cm^{-1} and 2200 cm^{-1}. Its ^1H–NMR spectrum consists of two doublets (J = 14Hz) at δ 5·9 and δ 7·1. Propose a structure consistent with these data. 6

(d) Suggest a structure for each of the following ions in the mass spectrum of butyrophenone ($PhCOCH_2CH_2CH_3$), and the mechanism by which each is formed. 7

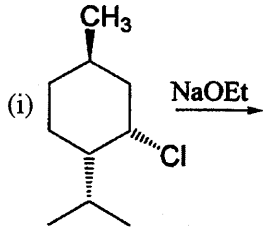
(i) m/z = 106 and

(ii) m/z = 120

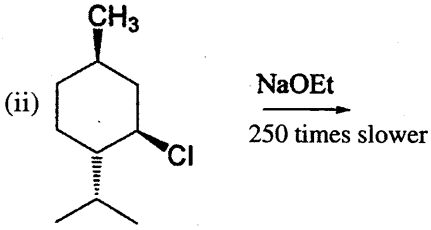
(e) Show with a reasonable mechanism how a carbene might be used in the synthesis of the following compound: 4



6. (a) Predict the major organic product formed in each of the following reaction. Explain why E2 elimination of diastereoisomer A proceeds 250 times faster than that of diastereoisomer B. 8

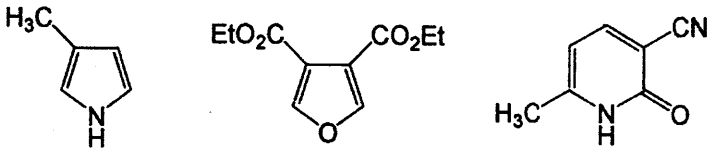


Diasteroisomer A

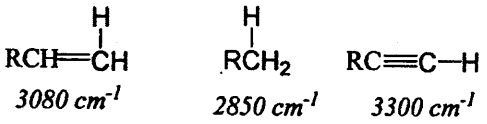


Diastereoisomer B

(b) How would you synthesize these aromatic heterocycles? 4×3=12



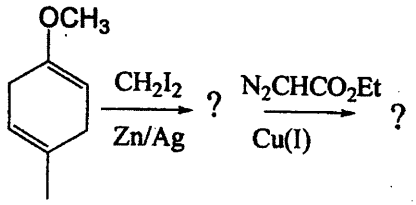
(c) Given the stretching frequencies for the C–H bonds shown, arrange the corresponding bonds in order of increasing strength. Explain your reasoning. 4



(d) Using 60 MHz spectrometer, a chemist observes the following absorption: doublet, J = 7 Hz at δ_H 4·00. How many hertz from the TMS peak is this absorption? Where would this peak be located (in ppm and in hertz) in the 100 MHz spectrum of this sample? What would J (coupling constant) be in the 100 MHz spectrum? 4

(e) Identify the geometric isomers of stilbene ($C_6H_5CH=CHC_6H_5$) from their λ_{max} value of 294 and 278 nm. 3

(f) Predict the product in these two reactions and then comment on the selectivity shown. 5



(g) Treating 3-methyl-2-butanol with HBr yields 2-bromo-2-methylbutane as the sole product. Propose a mechanism that explains the course of reaction. 4

2021

CHEMISTRY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be written either in ***English*** *or in* ***Bengali*** *but all answers must be in one and the same language.*

Section-I

This Section comprises 15 questions in three Groups. Answer *any ten* questions taking *at least three* questions from each Group.

Group-A

1. Which among the following bidentate ligands would you expect to give innermetallic hexa-coordinated complexes with transition metals M^{3+} ions? $H_2N–CH_2–COOH$, HOOC–COOH, $H_3C–CO–CH_2–CO–CH_3$. Justify your answer. 4

2. Explain the phenomenon due to which $Ni(CO)_4$ has got stability despite zero valent state of Nickel. 4

3. The enthalpy of hydration of the Fe^{2+} ion is 11·4 kcal/mol higher than would be expected if there were no crystal field stabilisaton energy. Assuming the aqua complex to be high spin, estimate the magnitude of Δ_0 for $Fe(H_2O)_6^{2+}$. 4

4. The aqueous solution of $\left[Ti(OH_2)_6\right]^{3+}$ show a maximum absorption around 20,300 cm^{-1} in its electronic spectrum. Express the band position in nm. Has the complex ion visible in colour? 4

5. Evaluate the ground state term for a free metal ion with $3d^7$ configuration. 4

Group-B

6. Define partial molar volume. Can it be negative? Justify your answer. 4

7. Draw a potential energy profile for an exothermic reaction clearly identifying the activation energy and transition state. In the same diagram indicate the effect of addition of catalyst to the system. 4

8. Write Arrhenius equation for the temperature dependence of the rate constant identifying all the parameters. What will be the dimension of the pre-exponential factor for a second order reaction? 4

9. Define number and weight-average molecular weights of polymers. Name one experimental technique each to determine them. 4

10. State the selection rules for rotational transition of a symmetric rotor. 4

Group-C

11. Write a conformational structures for all of the stereoisomers of 1,3-diethylcyclohexane. Label pairs of enantiomers and meso compounds if they exist. 4

12. Predict the stereochemistry of the thermal electrocyclic ring closure of (2E,4Z,6E)–2,4,6-octatriene to 5,6-dimethyl-1,3-cyclohexadiene. 4

13. An enantiomerically pure sample of (*S*)–(+)–2-butanol shows a specific rotation of +13·52°. The mixture of 2-butanol enantiomers shows a specific rotation of +6·76°. What is the percent enantiomeric excess of this sample? 4

14. *trans*-1,2-dimethylcyclopropane is more stable than that of its *cis* isomer. Use Newman projection to explain this observation. 4

15. Draw three dimensional representation(s) of 1-chloro-3-methyl-1,2-pentadiene. Is this compound chiral? Justify your choice. 4

Section-II

This Section comprises *six* questions in three Groups. Answer *any four* questions taking *at least one* question from each Group.

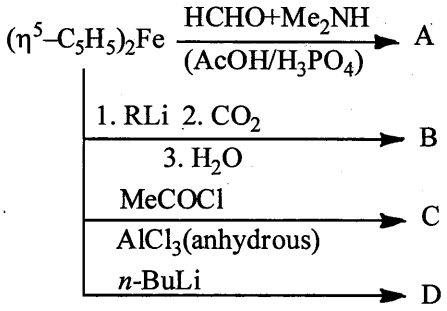
Group-A

1. (a) One red coloured co-ordination compound (A) slowly transforms into another coordination compound (B), that is yellow in colour. Elemental analysis of both A and B give the same composition $Co:NH_3:Cl:NO_2 = 1:5:2:1$. One millimole of each of A and B on treatment with an excess of $AgNO_3$ solution in dilute HNO_3 medium give two millimole of AgCl.

   Write the possible co-ordination formula of A and B, give their IUPAC names and rationalize the transformation A→B. 8

   (b) Explain the biological functions of haemoglobin and myoglobin stating the role of the metal ion(s) present at their active sites. 4+4=8

(c) Identify the compounds A, B, C and D in the following reaction sequence: 8



(d) Using 18-electron rule as guide, find the number (x) of CO ligands in the following compounds: 3+3=6

(i) $\left[Co(\eta^5\text{-}C_5H_5)(CO)_x\right]$

(ii) $Fe(CO)_x(NO)_2$

(e) Explain the following terms with an example in each: 4+3+3=10

(i) Insertion reaction (ii) Oxidative addition reaction (iii) Reductive elimination reaction

2. (a) Construct the orgel diagram for $[CrF_6]^{3-}$ and assign the three electronic transition bands found at 14900 cm^{-1}, 22400 cm^{-1} and 34800 cm^{-1}. Find out the value of 'Dq' amount. 8+2=10

(b) What is *trans* effect? Outline a synthetic route for the synthesis of *cis* and *trans* $[Pt(NH_3)(NO_2)Cl_2]^-$.

(Given: The *trans* directing influence is $NH_3 < Cl^- < NO_2^-$) 4+3+3=10

(c) Chromium (II) fluoride and manganese (II) fluoride both have a central metal ion surrounded by six fluoride ligands. The Mn–F bond lengths are equidistant but four of the Cr–F distances are long and other two are short. Provide an explanation. 4

(d) The complexes $[Mn(H_2O)_6]^{2+}$, $[Fe(H_2O)_6]^{3+}$, $[MnCl_4]^{2-}$ and $[FeCl_4]^-$ all have magnetic moments of nearly 5·92 B.M. What does this tell you about the geometric and electronic structures of these complexes? Why is the spin-only formula so precise in these cases? 6

(e) Draw the molecular structure of the following complexes: 1·5×4=6

(i) *cis*-dichlorotetracyanochromate (III)

(ii) *mér*-triamminetrichlorocobalt (III)

(iii) *trans*-dichlorobis (trimethylphosphine) palladium (II)

(iv) *fac*–triaquatrinitro cobalt (III)

(f) Explain the term 'Chelate effect'. Why is it called entropy effect? 4

Group-B

3. (a) Consider the expression:

$$F = C - P + 2$$

What is F? How is C defined? For a NaCl soution what will be C? Justify your answer. 6

(b) What is half-life of a reaction? Obtain the expression of half-life for a second order reaction. 4

(c) For the reaction

$$A+B \rightleftharpoons I \rightarrow P$$

obtain an expression for $d[P]/dt$ using a steady state approximation. 6

(d) Draw Jablonski diagram. Describe the mechanism of fluorescence. In what respects is a fluorescence spectrum not the exact mirror image of the corresponding absorption spectrum? 12

(e) For a stepwise polymerization reaction obtain an expression for degree of polymerization as a function of reacted monomers.

Consider a polymer formed by a stepwise process with a rate constant 1·00 $dm^3\ mol^{-1}s^{-1}$ and an initial monomer concentration of $[A]_0 = 4{\cdot}00\times10^{-3}$ $mol.dm^{-3}$. Calculate the degree of polymerization at time $t = 1{\cdot}5\times10^4$s. 12

4. (a) What is Lambert-Beer law? Define molar extinction coefficient and obtain its units in SI system.

A radiation of wavelength 280 nm was passed through 1·0 mm of an aqueous solution containing a chromophore at a concentration of 0·50 m mol. dm^{-3}. The light intensity is reduced to 54% of its initial value. Calculate the molar extinction coefficient of the chromophore. What would be the transmittance through a cell of thickness 2·0 mm? 12

(b) Collision theory depends on knowing the fraction of molecular collision having at least the kinetic energy E_a along the line of flight. What is this fraction when E_a = 100 kJ/mol at 300 K? Calculate the percentage increase in fractions when the temperature is raised by 10 K. 5

(c) Derive the rate law for the decomposition of Ozone in the reaction $2O_3(g) \rightleftharpoons 3O_2(g)$ on the basis of the following mechanism: 6

$$O_3 \rightarrow O_2 + O \; K_a$$

$$O_2 + O \rightarrow O_3 \; K'_a$$

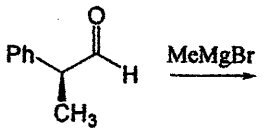
$$O + O_3 \rightarrow O_2 + O_2 \; K_b$$

(d) What is chemical potential of a pure substance? What happens to it when (i) temperature is raised, (ii) pressure is raised? Justify your answer. The standard molar entropy of liquid water at 100°C is $86 Jk^{-1}mol^{-1}$ and that of water vapour at the same temperature is 196 $Jk^{-1}\ mol^{-1}$. What is the effect of increasing the temperature by 1·0 K? Comment on the spontaneity of the vapourization process. 10

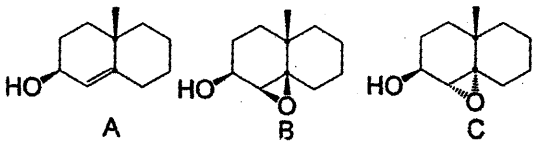
(e) What is physisorption? Define fractional coverage. For a spontaneous absorption process the enthalpy of absorption is negative. — Justify or criticize this statement. 7

Group-C

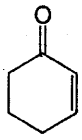
5. (a) Draw the stereochemistry of the major organic product formed in the following reaction. Justify your choice. 5

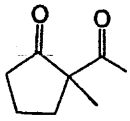


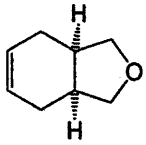
(b) Show how would you convert the allylic alcohol A into compounds B and C. 6



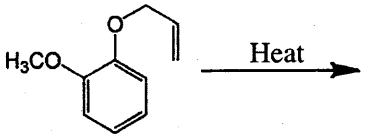
(c) Show giving reasonable mechanism how the following compounds might be synthesized: 15

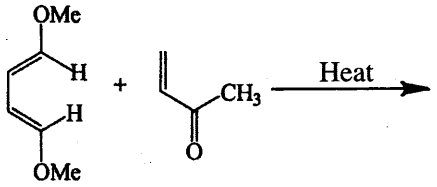
(i)  from C_6H_5OMe

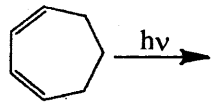
(ii)  OC_2H_5 from diethyl hexanedioate

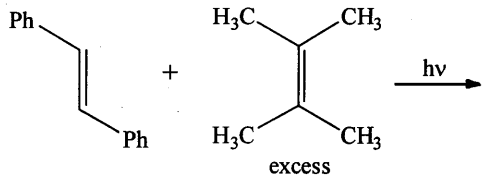
(iii)  from butadiene

(d) Predict the product formed in each of the following reaction. Explain their formation. 14

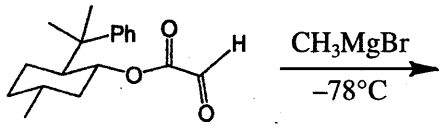
(i) 

(ii) 

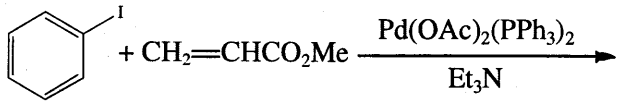
(iii) 

(iv) 

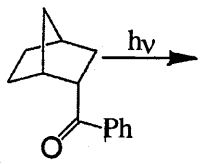
6. (a) Draw the stereochemistry of the major organic product formed in the following reaction. Justify your choice using Prelog's rule. 5

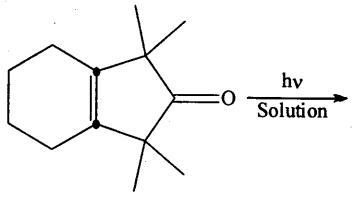


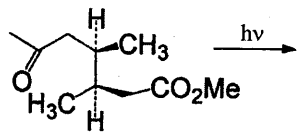
(b) Predict the structure of the product(s) formed in the following reaction and give a mechanism. 5

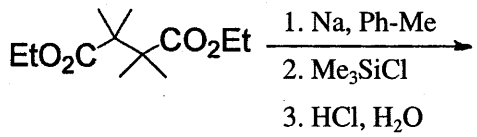


(c) Write the product(s) in the following reactions. Explain their formation. 20

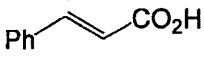
(i) 

(ii) 

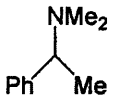
(iii) 

(iv) 

(d) Outline a synthetic route for each of the following compounds. Propose plausible mechanism. 10

(i) 

using PhCHO & Ac_2O

(ii) 

from PhCOMe

2021

CIVIL ENGINEERING

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be written either in **English** *or in* **Bengali** *but all answer must be in one and the same language.*

All notations / symbols have their usual meanings, unless otherwise specified.

Group-A

Answer *any four* questions. 35×4=140

1. (a) A group of 9 piles, 12 m long and 250 mm in diameter, is to be arranged in a square form in a clay soil with an average unconfined compressive strength of 60 kN/m^2. Determine the centre to centre spacing of the piles for a group efficiency factor of 1. Take adhesion factor as 0.9. Neglect bearing action at the tip of the piles. 15

   (b) A partially saturated soil sample from a borrow pit has a natural moisture content of 15% and bulk density of 1.9 gm/cc. The specific gravity of solids is 2.70. Determine the degree of saturation and void ratio. What will be the density of the soil sample on saturation? 10

   (c) A retaining wall, 8 m high, with a smooth vertical back, retains a clay backfill with $c' = 15$ kN/m^2, $\phi = 15°$ and $\gamma = 10$ kN/m^3. Calculate the total active thrust on the wall assuming that tension cracks may develop to the full theoretical depth. 10

2. (a) A 8 m thick clay layer with single drainage settles by 120 mm in 2 years. The coefficient of consolidation for this clay was found to be 6×10^{-3} cm^2/s. Calculate the likely ultimate consolidation settlement and find out how long it will take to undergo 90% of this settlement. 15

   (b) An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 37.5 mm and was 80 mm long. The load at failure measured by the proving ring was 28 N and the axial deformation of the sample at failure was 13 mm. Determine the unconfined compressive strength and the undrained shear strength of clay. 10

   (c) The *in situ* void ratio of a granular soil deposit is 0.50. The maximum and minimum void ratios of the soil were determined to be 0.75 and 0.35. Specific gravity of the soil was 2.67. Determine the relative density and relative compaction of the deposit. 10

3. A horizontal beam of uniform cross-section is pinned at its ends which are at the same level and is loaded at the left hand pin with an anticlockwise moment of M and at the right hand pin with a clockwise moment of 2M both in the same vertical plane. The length between the pins is l. Find the angles of slope at each end and the deflection of the midpoint of the span in terms of M, l, E, I. Symbols used have their own meaning. 35

4. Draw the shear force and bending moment diagrams for the beam shown in Fig.-1. 35

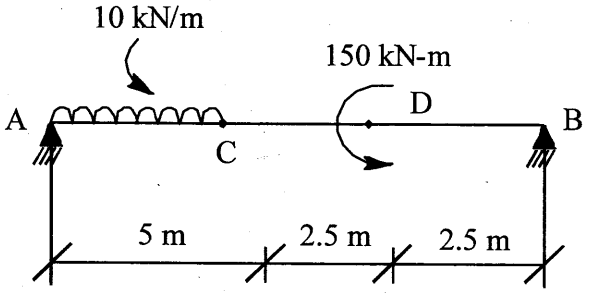


Fig.-1

5. (a) For the subsoil conditions shown in Fig.-2 determine total stress, neutral stress and effective stresses at 3 m, 5 m and 8 m depth below ground level. Also draw the stress distribution diagram for total stress, neutral stress and effective stress. Given that, unit weight of water is 10 kN/m^3. 15

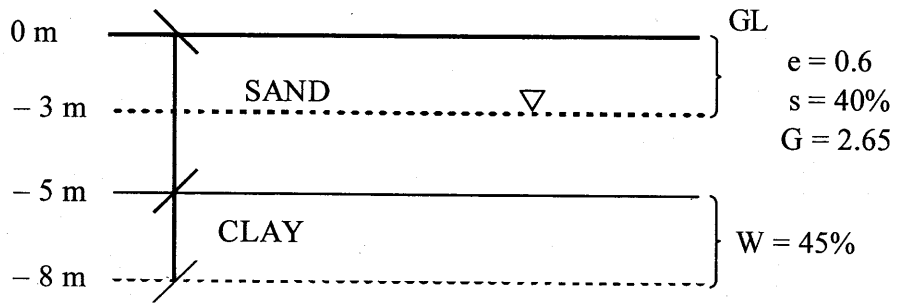


Fig.-2

(b) A clay soil, tested in a consolidometer, showed a decrease in void ratio from 1.20 to 1.10 when the pressure was increased from 0.25 to 0.50 kgf/cm^2. Calculate the coefficient of compressibility (a_v) and coefficient of volume compressibility (m_v).

If the coefficient of consolidation (c_v) determined in the test for the given stress increment was 10 m^2/year, calculate the coefficient of permeability in cm/s.

If the sample tested at the site was taken from a clay layer of 3.0 m in thickness, determine the consolidation settlement in 'mm' resulting from the given stress increment. 10

(c) Determine the safe load that can be carried by a squre footing of 2.2 m × 2.2 m size, placed at a depth of 1.6 m below GL. The foundation soil has the following properties:

$\gamma = 1.65$ t/m^3, $c = 1.1$ t/m^2, $\phi = 20°$

Assume a factor of safety of 2.5. Given for $\phi = 20°$, $N_c = 17.7$, $N_q = 7.4$, $N_\gamma = 5.0$

$N'_c = 11.8$, $N'_q = 3.8$, $N'_\gamma = 1.3$ 10

Group-B

Answer *any four* questions. 15×4=60

6. An RCC beam, 200 mm × 400 mm (effective) is reinforced with 3 nos. 16 mm diameter bars of Fe415 steel. Find the ultimate uniformly distributed load which the beam can carry safely over a span of 5 m. Use M20 grade concrete. Use limit state method of design. 15

7. A cast iron test beam 20 mm × 20 mm in section and 1 metre long and simply supported at the ends fails when a central load of 640 N is applied. What uniformly distributed load will break a cantilever of the same material of 50 mm wide, 100 mm deep and 2 metres long? 15

8. For a field pumping test, a well was sunk through a horizontal stratum of sand 14.5 m thick and underlain by a clay stratum. Two observation wells were sunk at horizontal distances of 16 m and 34 m respectively from the pumping well. The initial position of water table was 2.2 m below ground level. At a steady state pumping rate of 925 litres/min, the draw downs in observation wells were found to be 2.45 m and 1.20 m respectively. Calculate the cofficient of permeability of the sand. 15

9. In an *in situ* vane shear test on a saturated clay, a torque of 35 Nm was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay.

   The vane was then rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in the remoulded state was 5 Nm. Determine the sensitivity of the clay. 15

10. Calculate the coefficient of permeability of a soil sample 6 cm in height and 50 cm^2 in cross sectional area, if a quantity of water equal to 450 ml passed down in 10 minutes under an effective constant head of 40 cm. On oven drying, the test specimen weighs 495 gm. Taking the specific gravity of soil as 2.65 calculate the seepage velocity of water during the test. 15

2021

CIVIL ENGINEERING

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answer may be given either in **English** *or in* **Bengali** *but all answer must be in one and the same language.*

All notations / symbols have their usual meanings, unless otherwise specified.

Group-A

Answer *any four* questions.

1. (a) Define water requirement of crops. How it differs to irrigation water requirement?

   (b) With a neat sketch show the trapezoidal section of a canal and label it.

   (c) Discuss the canals classified based on the source of supply.

   (d) The following readings (in units) were taken in leveling operation from stations which were completed in three settings:

   First setting 4, 6

   Second setting 3, 5, 4

   Third setting 5, 7, 9, 6

   Calculate the reduced levels of all the stations by assuming the reduced level of the starting station as 100. 4+8+8+12=32

2. (a) What is chain surveying? When chain survey is preferred?

   (b) A and B are two points 100m apart on the near bank of a river which flows east and west. The bearings of the tree on the far bank as observed from A and B are N50°E and N40°W. Determine the width of the river.

   (c) What is the expected flow in rectangular lined channel of 2.5m wide and flowing 1.5m deep with bed slope 1 in 5000 calculated by using Manning's equation? What is the expected value of Chezy's C for this flow? Assume Manning's $n = 0{\cdot}01$.

   (d) With the necessary sketch derive the expression for steady flow of a tubewell completely penetrated in confined aquifer. 4+8+8+12=32

3. (a) Define water well, specific yield & specific retention, transmissibility & aquitard.

   (b) A 300 mm × 300 mm reinforced concrete member has to support an axial compressive load of 350 kN. If the stress in concrete is not to exceed 5 N/mm^2, calculate the area of steel required. Take m = 18.

(c) Differentiate primary and secondary pollutants in air. What are the sources of air pollution? Discuss in short the human health effects of air pollution.

(d) Discuss the considerations which should be complied in designing vertical curves in designing roadways. 8+6+(4+4+4)+6=32

4. (a) The following are the observed fore bearings of the lines: AB, 88°30′; BC, 142°15′; CD, 209°10′; DE, 324°45′. Find their back bearings.

(b) Discuss the isohyetal method of estimating mean precipitation over an area.

(c) Define concrete and cement. Name the different type of tests conducted in the laboratory to determine the quality of cement.

(d) What are the important surface characteristics of pavement and which influence these characteristics? 12+8+(2+4)+6=32

5. (a) Compare between the flexible and rigid pavement. What are the requirements of a pavement? What are typical layers of a flexible pavement?

(b) Determine the discharge of a canal of bed width = 2·0 m, depth of water = 1·5 m, side slope = 1·5:1 and longitudinal slope = 1 in 1000. Assume Manning's n = 0·04.

(c) What are the functions of traffic separators? What is cross slope or camber? What is the use of it? (4+4+4)+12+8=32

6. Write short notes of the following: 4x8=32

(a) Quick setting cement

(b) Effluent and influent stream

(c) Profile surveying

(d) Workability of concrete

(e) Road margins

(f) Oxidation ponds

(g) Waste incineration

(h) Activated sludge

Group-B

Answer *any two* questions.

7. (a) What is highway planning? Why are curves used in roadway horizontal and vertical alignment?

(b) Distinguish between (i) level line and horizontal line (ii) datum and benchmark (iii) resection and intersection method as applied in plane table survey.

(c) Discuss the biochemical oxygen demand (BOD).

(d) What is superelevation in a road? Describe the design consideration of it.

(e) A city wastewater treatment plant discharging at a rate of 1·2 m^3/s having BOD of 55·0 mg/l in to a stream which has a flow of 8·50 m^3/s and the BOD of its own equal to 5·0 mg/l. Estimate the BOD of the stream at 5·0 kilometer downstream. Assume the stream velocity as 0·2 m/s and the deoxygenation constant (k_d) 0·20/day. 6+(4×3)+6+8+4=36

8. (a) Discuss the major pollutants that contaminate water.

(b) Describe the different type of sight distances in roadway.

(c) Calculate the amount of water flowing into a aquifer extending to a length of 20 kilometer for the following data:

Average permeability of the aquifer = 5 m/hour

Average thickness of the aquifer = 20 m

Piezometric gradient = 10 in 1500

(d) Find the true horizontal distance which when measured along a 1 in 25 rising slope was found to be 754 meters.

(e) The rainfall intensity for the period of time of concentration of a watershed is 25 mm/h. The area of the watershed is 2·5 square kilometer and the run-off coefficient is 0·3. What is the peak run-off rate?

(f) Derive the expression for equivalent concrete area.

(g) What is a contour line? Differentiate palatable and potable water. 8+6+4+4+4+6+4=36

9. (a) Discuss the rational formula for estimating peak run-off rate of a watershed. What are the disadvantages of it?

(b) What are aggregates and all-in-aggregates? Discuss the minimum void method of proportioning concrete mix.

(c) What are the factors a designer should consider to develop an effective and efficient geometry in road alignment?

(d) What are the elements of a horizontal curve?

(e) What are the reasons for widening of pavement on horizontal curves?

(f) Discuss coagulation, flocculation, sedimentation and filtration as the process of water treatment.

(g) Discuss well development. 8+(2+4)+4+4+4+6+4=36

10. (a) What is orientation of plane tabling? Discuss the methods of orientation.

(b) The distance along a sloping ground were measured with 30·0 m chain were 30·7, 25·2, 17·3 and 36·8 m respectively and the corresponding slope angles were found to be 2°, 4·5°, 6°, 9° respectively. It was noted afterwards that the chain was 0·02 m too short. Find the true horizontal distance.

(c) Define duty of water, consumptive use of crop, irrigation efficiency and wilting point.

(d) A canal has a bed width of 4·0 m and side slope of 2:1. What is the economic cross section of it?

(e) What are the advantages and the disadvantages of lined channels? 12+8+4+6+6=36

2021

PHILOSOPHY

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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Answers may be given either in ***English*** *or in* ***Bengali*** *but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. Critically examine Mill's theory of Justice and Liberty. 40

2. (a) Explain the main claims of Anarchism.

   (b) Describe the relation between Anarchism and Democracy. 20+20=40

3. (a) Discuss the meaning and significance of Secularism.

   (b) Explain how Secularism is related to Multiculturalism. 20+20=40

4. Critically explain Freud's theory of Dream. 40

5. Explain and examine the Cartesian Dualism. 40

Group-B

Answer *any two* questions.

6. How does Aristotle show that every moral virtue is a mean between excess and deficiency? Explain with some of the examples given by Aristotle in support of his claim. 40

7. What does Kant mean by Categorical Imperative? How is it related to Goodwill? 20+20=40

8. Critically explain the auto Ontological argument for the existence of God. 40

2021

BENGALI

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

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(উত্তর সাধু বা চলিত যেকোনো একটি ভাষারীতিতে হওয়া বাঞ্ছনীয়)

'ক' বিভাগ

(*যেকোনো একটি* প্রশ্নের উত্তর লিখুন।) ৫০×১=৫০

১। (ক) মধ্য-ভারতীয় আর্যভাষার স্তরগুলির নাম লিখুন এবং প্রতিটি স্তরের কালসীমা বিবৃত করুন। প্রতিটি স্তরের উপভাষাগুলির নাম লিখুন। মধ্য-ভারতীয় আর্যভাষার ধ্বনিতাত্ত্বিক বৈশিষ্ট্যগুলি উদাহরণসহযোগে উল্লেখ করুন। ১০+১৫+২৫=৫০

(খ) বাংলা শব্দভাণ্ডারের বৈশিষ্ট্য উপযুক্ত উদাহরণসহ বর্ণনা করুন। ৫০

'খ' বিভাগ

(*যেকোনো দুটি* প্রশ্নের উত্তর লিখুন।) ৫০×২=১০০

২। চর্যাপদের সাহিত্যমূল্য নির্ধারণ করুন। ৫০

৩। মধ্যযুগের মুসলমান কবিরা যে মানবপ্রেমের আখ্যান রচনা করেছিলেন, সেগুলির বিষয়ে বিশদ আলোচনা করুন। ৫০

৪। ভারতচন্দ্র রায় রচিত 'অন্নদামঙ্গল' কাব্যটি 'নূতন মঙ্গল' অভিধায় ভূষিত হবার কারণগুলি সম্বন্ধে আপনার মত লিপিবদ্ধ করুন। ৫০

৫। বাংলা নাট্যসাহিত্যে দীনবন্ধু মিত্রের অবদানের বিষয়টি বিশ্লেষণ করুন। ৫০

'গ' বিভাগ

(*যেকোনো একটি* প্রশ্নের উত্তর লিখুন।) ৫০×১=৫০

৬। উনিশ শতকের বাংলা কাব্যের ধারায় মধুসূদন দত্তের অবদান সম্পর্কে আলোচনা করুন। ৫০

৭। তারাশংকর বন্দ্যোপাধ্যায়ের রচনায় রাঢ় অঞ্চলসংলগ্ন সাধারণ মানুষজনের সুখদুঃখ যে অভিনব রসমূর্তি নিয়ে দেখা দিয়েছে — সে বিষয়ে, তাঁর কয়েকটি উপন্যাস অবলম্বনে বিস্তৃত আলোচনা করুন। ৫০

৮। স্বাবলম্বী নারীচরিত্র নির্মাণে নবনীতা দেবসেনের যে অপরিসীম দক্ষতা—তাঁর কয়েকটি উপন্যাস অবলম্বনে সে বিষয়টি প্রতিপন্ন করুন। ৫০

2021

BENGALI

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

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(উত্তর সাধু বা চলিত যেকোনো একটি ভাষারীতিতে হওয়া বাঞ্ছনীয়)

বিভাগ-ক

(*যেকোনো তিনটি* প্রশ্নের উত্তর লিখুন) ৪০×৩=১২০

১। বৈষ্ণব পদকারদের কাছে 'পূর্বরাগ' কথাটির প্রকৃত তাৎপর্য কী? এই পর্যায়ের পদরচনায় বিদ্যাপতি ও চণ্ডীদাসের কবিপ্রতিভার তুলনামূলক আলোচনা করুন।

২। "মুকুন্দরাম দুঃখের কথায় পঞ্চমুখ বটেন, তবু তাঁহাকে নৈরাশ্যবাদী কবি বলা যায় না।"— কালকেতুর উপাখ্যানের সামগ্রিক রসাবেদনের প্রেক্ষিতে এই মন্তব্যটি সমর্থন অথবা প্রত্যাখ্যান করুন।

৩। 'মেঘনাদবধ কাব্যে'র প্রথম সর্গে রাবণ ও চিত্রাঙ্গদার সংলাপের মধ্যে দিয়ে উভয় চরিত্রের যে বৈশিষ্ট্য পরিস্ফুট হয়েছে উপযুক্ত উদ্ধৃতিসহ তা আলোচনা করুন।

৪। কপালকুণ্ডলা উপন্যাসের সূচনা থেকে সমাপ্তি পর্যন্ত প্রকৃতি এক অমোঘ ভূমিকায় অবতীর্ণ — উপন্যাসের ঘটনা-সংস্থান, চরিত্র বিকাশ ও পরিণতি এই প্রকৃতির দ্বারা প্রত্যক্ষ ও পরোক্ষভাবে কতখানি নিয়ন্ত্রিত হয়েছে লিখুন।

৫। "এই গ্রন্থের পরিচয় আছে 'বাজে কথা' প্রবন্ধে। অর্থাৎ ইহার যদি কোনো মূল্য থাকে তাহা বিষয়বস্তুগৌরবে নয়, রচনারস সম্ভোগে।"— 'বিচিত্র প্রবন্ধ' গ্রন্থের সূচনায় রবীন্দ্রনাথের এই মন্তব্য গ্রন্থটিতে কীভাবে সার্থক হয়ে উঠেছে প্রয়োজনীয় দৃষ্টান্তসহ আলোচনা করুন।

বিভাগ-খ

(*যেকোনো দুটি* প্রশ্নের উত্তর দিন) ৪০×২=৮০

৬। "চাণক্যের অসাধারণ ব্যক্তিত্ব সমস্ত কাহিনীকে একেবারে আচ্ছন্ন করিয়া রাখিয়াছে, তাঁহার পাশে চন্দ্রগুপ্তকে নিতান্ত ম্লান ও অপরিস্ফুট মনে হইয়াছে।"— 'চন্দ্রগুপ্ত' নাটক সম্বন্ধে সমালোচকের এই মন্তব্যের পক্ষে বা বিপক্ষে আপনার অভিমত লিপিবদ্ধ করুন।

৭। 'আমার কৈফিয়ৎ' কবিতা অবলম্বনে কাজী নজরুল ইসলামের কবিমানসের বিশিষ্টতার পরিচয় দিন।

৮। ইন্দিরঠাকরুন-সর্বজয়া-দুর্গা, 'পথের পাঁচালী' উপন্যাসের এই তিনটি চরিত্রের মধ্যে দিয়ে বাংলার গ্রামসমাজে নারীর অবস্থানের তাৎপর্য চিহ্নিত করুন।

৯। সংগ্রামী চেতনা সাধারণ মানুষের চরিত্রে যে অসামান্যতা আনে তেভাগা আন্দোলনের পটভূমিতে ময়নার মায়ের চরিত্রে সেই অসামান্যতার দিকটি 'হারানের নাতজামাই' গল্প অবলম্বনে পরিস্ফুট করুন।

2021

MATHEMATICS

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be given either in **English** *or in* **Bengali** *but all answers must be in one and the same language.*

1. Answer *any two* questions: 10×2=20

(a) Consider the following subspaces of $\mathbb{R}^5$:

$U = \text{span}\{(1, 3, -2, 2, 3), (1, 4, -3, 4, 2), (2, 3, -1, -2, 9)\}$

$W = \text{span}\{(1, 3, 0, 2, 1), (1, 5, -6, 6, 3), (2, 5, 3, 2, 1)\}$

Find a basis and the dimension of U+W. Hence find the dimension of $U \cap W$.

(b) Let $f: \mathbb{R}^4 \to \mathbb{R}^3$ be the linear mapping defined by

$f(x, y, z, \omega) = (x-y+z+\omega, x+2z-\omega, x+y+3z-3\omega)$

Find a basis and the dimension of the (i) image of f and (ii) the kernel of f.

(c) Using Cayley-Hamilton Theorem, find A^9 where

$$A = \begin{pmatrix} 1 & 0 & 2 \\ 0 & -1 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

2. Answer *any two* questions: 10×2=20

(a) Prove that the sequence $\sqrt{2}, \sqrt{2+\sqrt{2}}, \sqrt{2+\sqrt{2+\sqrt{2}}}$, ... is monotonic increasing. Is the sequence bounded? Justify your answer.

(b) Find the value of $\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right)$.

(c) Show that the maximum value of $\left(\frac{1}{x}\right)^x$ is $e^{1/e}$.

3. Answer *any two* questions: 10×2=20

(a) Evaluate $\lim_{n\to\infty}\left\{\frac{n!}{(pn)^n}\right\}^{1/n}$, $p \neq 0$.

(b) Test the convergence of the series $2-\frac{3}{2}+\frac{4}{3}-\frac{5}{4}+.....$

(c) Evaluate, if possible $\int_0^{\pi}\frac{dx}{1-\cos x}$.

4. Answer *any two* questions: 10×2=20

(a) In the Mean Value Theorem, $f(h)=f(o)+hf'(\theta h), 0<\theta<1$. Show that the limiting value of θ as $h\to 0$ is $\frac{1}{2}$ where $f(x)=\cos x$.

(b) Find all the asymptotes of the curve $y=e^{6x}$.

(c) If $f(x)=x^n$, prove that

$$f(1)+\frac{f'(1)}{1!}+\frac{f''(1)}{2!}+\frac{f'''(1)}{3!}+.....+\frac{f^n(1)}{n!}=2^n.$$

5. Answer *any two* questions: 10×2=20

(a) Find the equation of the pair of straight lines through the origin and perpendicular to the pair of straight lines given by $3x^2+xy-2y^2-5x-5y=0$.

(b) If by a transformation of rotation of co-ordinate axes, the expression $cx+dy$ is changed into $c'x'+d'y'$, where c, c', d, d' are constants, then show that $c'^2+d'^2=c^2+d^2$.

(c) If the normal to an ellipse at the point P meets the major and minor axes at G and H respectively, then show that

PG.PH=SP.S'P

where S, S' are focii of the ellipse.

6. Answer *any two* questions: 10×2=20

(a) A variable plane which is at a constant distance $3p$ from the origin intersects the co-ordinate axes at A, B, C. Show that the locus of the centroid of Δ ABC is

$$\frac{1}{x^2}+\frac{1}{y^2}+\frac{1}{z^2}=\frac{1}{p^2}.$$

(b) Find the length of the shortest distance between the lines

$$\frac{x-3}{1}=\frac{y-5}{-2}=\frac{z-7}{1} \text{ and } \frac{x+1}{7}=\frac{y+1}{-6}=\frac{z+1}{1}.$$

(c) Find the equation of the sphere which passes through the points (1,0,0), (0,1,0) and (0,0,1) and radius as small as possible.

7. Answer *any two* questions: 10×2=20

(a) Reducing the differential equation $x^2p^2+p(2x+y)+y^2=0$ to Clairaut's form by the substitution $y=u,\ xy=v$, solve it. Find singular solution/s.

(b) Solve : $\left(D^2+D+1\right)y=e^{2x}$

(c) Solve the equation by the method of variation of parameters

$$\frac{d^2y}{dx^2}+a^2y=\sec\ ax$$

8. Answer *any two* questions: 10×2=20

(a) Solve : $z^2-pz+qz+(x+y)^2=0$

(b) Using Charpit's method, solve the equation $\left(p^2+q^2\right)y=qz$.

(c) Evaluate $L\{F(t)\}$ where

$$F(t)=\begin{Bmatrix}(t-1)^2, & t>1\\ 0 & , 0<t<1\end{Bmatrix}$$

9. Answer *any two* questions: 10×2=20

(a) Two uniform similar rods of same material PQ and QT of length $2a$ and $2b$ respectively are rigidly united at Q and suspended freely from P. If they rest inclined at angles α and β respectively to the vertical, prove that $\left(a^2+2ab\right)\sin\alpha=b^2\sin\beta$.

(b) A solid hemisphere of weight W rests in limiting equlibrium with its curved surface on a rough inclined plane and the plane face is horizontal by a weight P attached at a point in the rim. Prove that the co-efficient of friction is $\frac{P}{\sqrt{W(2P+W)}}$.

(c) Four equal rods each of weight W form a rhombus ABCD with smooth hinges at the joints. The frame is suspended by the end A and a weight W' is attached at C. A stiffering rod of negligible weight joins the middle points of AB and AD keeping these inclined at an angle α to AC. Show that the thrust in the stiffening rod is $(4W + 2W')\tan\alpha$.

10. Answer *any two* questions: 10×2=20

(a) The velocities of a point parallel to the axes of x and y are $u+\omega y$ and $v+\omega' x$ respecitvely, where u, v, ω, ω' are constants. Show that the path of the point is a conic.

(b) A particle moving with a simple harmonic motion in a straight line has velocities v_1, v_2 at distances x_1, x_2 from the centre of its path. Show that, if T be the period of its motion, then,

$$T = 2\pi\sqrt{\frac{x_1^2 - x_2^2}{v_2^2 - v_1^2}}.$$

(c) Assuming the moon to describe a circular orbit of radius 4×10^5 km round the earth in 27·3 days, calculate the periodic time of an artificial satellite of the earth near the earth's surface (Radius of the earth = 6400 km).

2021

MATHEMATICS

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer any four *questions.*

1. (a) Show that each root of $x^7 - 1 = 0$ is a non negative integral power of $\alpha = \cos\frac{2k\pi}{7} + i\sin\frac{2k\pi}{7}$, $k \in Z$ and also prove that the roots of $x^2 + x + 2 = 0$ are $(\alpha + \alpha^2 + \alpha^4)$ and $(\alpha^3 + \alpha^5 + \alpha^6)$. 5+10=15

   (b) Find the special roots of the equation $x^9 - 1 = 0$ and show that they are roots of the equation $x^6 + x^3 + 1 = 0$. 5+5=10

2. (a) Suppose H is the only subgroup of finite order m in the group G. Prove that H is a normal subgroup of G. If G is a finite group and H is a normal subgroup of G, then prove that $O\left(\frac{G}{H}\right) = \frac{O(G)}{O(H)}$. 10+5=15

   (b) Let Z denote the centre of a group G. If G/Z is cyclic group prove that G is abelian. 10

3. (a) Determine the point where the function is minimum $x^2 + y^2 + (x + y + 1)^2$. 10

   (b) (i) If the vectors $\vec{A}$ and $\vec{B}$ be irrotational, then show that the vector $\vec{A} \times \vec{B}$ is solinoidal.

   (ii) Use Stokes' theorem to evaluate $\oint_C (\cos x dx + 2y^2 dy + z dz)$, where C is the curve $x^2 + y^2 = 1, z = 1$. 5+10=15

4. (a) Let l_p be the set if all real sequences for which $\sum_{i=1}^{\infty} |x_i|^p < \infty$. We define the metric d in l_p by $d(x,y) = \left(\sum_{i=1}^{\infty} |x_i - y_i|^p\right)^{\frac{1}{p}}$, $\forall x = \{x_i\}$ and $y = \{y_i\} \in l_p$, then prove that the space (l_p, d) is a complete metric space. 15

(b) Consider the function f defined by

$$f(z) = 0, \text{when } z = 0$$

$$= \frac{x^3 - y^3}{x^2 + y^2} + i\frac{\left(x^3 + y^3\right)}{x^2 + y^2}, \text{when } z \neq 0.$$

Then show that the function f satisfies the Cauchy-Riemann equation at the origin. 10

5. (a) Prove that $\iint\left\{2a^2 - 2a(x+y) - (x^2+y^2)\right\}dx\,dy = 8\pi dt$. The region of integration being the circle $x^2 + y^2 + 2a(x + y) = 2a^2$. 15

(b) Show that $1!\ 3!\ 5!\ldots\ \ldots\ \ldots(2n-1)! > (n!)^n$. 10

Group-B

Answer any four *questions.*

6. (a) Use Picard's method to compute $y(0{\cdot}1)$, from the differential equation $\frac{dy}{dx} = x + y;\ y = 1$, when $x = 0$, correct to five decimal places. 15

(b) Express the Boolean function $f = x + (x' \cdot y' + x' \cdot z')$ in full disjunctive normal form. 10

7. (a) Find the mean and standard deviation of the following probability distribution $f(x) = Ce^{-\frac{1}{24}(x^2-6x+5)}, -\infty < x < \infty$. Find C. 2½+2½+10=15

(b) If independent random variables X and Y be each uniformly distributed in the interval $(-a, a)$, then find the distribution of

(i) X + Y

(ii) $\frac{X}{Y}$ 5+5=10

8. (a) The first two moments of a sample of size 'n' about the value 4 are 12 and 220 respectively. Find the mean and variance of the observation. 5+10=15

(b) If the relation between variables X and Y, U and V are 2X + 3Y = 4, 3U + 4V = 5 and the regression coefficient of X on U is 4, find the regression coefficient of Y on V. 10

9. (a) Write down the dual of the following L.P.P.

Maximize $Z = 3x_1 + 4x_2$

Subject to $x_1 + x_2 \leq 10$

$2x_1 + 3x_2 \leq 18$

$x_1 \leq 8$

$x_2 \leq 6$

$x_1, x_2 \geq 0.$

Also solve it by using dual problem. 5+10=15

(b) Find the optimal solution and the corresponding cost of transportation in the following transportation problem: 10

	D_1	D_2	D_3	D_4	a_i
O_1	19	20	50	10	7
O_2	70	30	40	60	9
O_3	40	8	70	20	18
b_j	5	8	7	14	

10. (a) Draw a circuit which realises the Boolean function $f = (x + y).(y + z).(z + x)$. Use the law of Boolean algebra to show that the above circuit is equivalent to a switching circuit in which if any two switches are on, the light is on and construct the equivalent switching circuit.

5+10=15

(b) There are 40 students in Statistics (Hons) class in a particular college. If the habit of borrowing books from college library of a student is $\frac{2}{5}$, find the minimum number of copies of a book, referred in a class, to be kept in the library so to meet more than 90% demand of the students.

10

2021

MANAGEMENT

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Group-A

Answer *any three* questions.

1. (a) Depict the phases of the evolution of Management Thought highlighting distinguished characteristic features of each phase.

   (b) Outline the functions of different levels of management in a large organisation. 30+10=40

2. (a) How can you make an effective plan for a modern organisation? Elaborate the steps with reasoning.

   (b) Explain and exemplify Policy and Strategy. 30+10=40

3. (a) How would you make decisions under certainty, risk and uncertainty? Discuss with suitable examples.

   (b) Describe the decision making guidelines for a group in an organisation. 30+10=40

4. (a) Draw Managerial Grid of leadership and elucidate it with appropriate examples.

   (b) What do you mean by span of control? Classify span of control. Discuss the factors responsible for the span of control of an organisation. 25+15=40

5. (a) Describe four important control techniques with examples.

   (b) Distinguish between maintenance and crisis management. 28+12=40

Group-B

Answer *any two* questions.

6. (a) 'Centralisation is something which goes to increase the authority of superior and decentralisation is something which goes to increase the authority of subordinates.' Elucidate with appropriate examples.

(b) How would you manage conflict in an organisation? Give an idea of management of charge. 20+10+10=40

7. (a) Make a critical review of contributions of Mary Parker Follett.

(b) Explain the concept of line and staff relationship in an organisation. Make a diagrammatic presentation of line and staff relationship in a large organisation. 25+5+10=40

8. (a) How can you find synergy in organisational activities under Six Sigma?

(b) How can management be more efficient and effective through the application of information technology? 20+20=40

9. Write notes on the following: 10×4=40

(a) Power and Authority

(b) Perception and Attitudes

(c) Supply Chain Management

(d) Management of Innovation

2021

MANAGEMENT

PAPER-II

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Answer *any five* questions.

1. (a) What are the set of Marketing tools that a company uses for fulfilling marketing objectives? 20

   (b) What are the major factors that influencing Buying Behavior? 20

2. (a) What are the recent growth of marketing channels to the inception of new wholeselling and retailing institutions? 20

   (b) Find out pricing method, given customer's demand, cost function and competitor's price. 20

3. (a) Define average cost of Capital and cost of Debt Capital and Preference Capital. 8+8+8=24

   (b) What are the sources of Working Capital? Briefly enumerate 'Operating Cycle Analysis' to understand various components of Working Capital. 8+8=16

4. (a) Concept of Strategic Human Resource Management (SHRM) is to develop environment of creativity within organisation. How will you analyse this concept? 20

   (b) Methods of Orthodox Performance appraisal is not suitable in the present business scenario. — Explain. 20

5. (a) Compare the grievance redressal process which may be effectively implemented in Govt. organisation and Private organisation. 20

   (b) How will you decide optimal manpower deployment in a specific work-place? Relate your exercise with job specification-design. 20

6. A Ltd. has 3 Departments X, Y, Z. From the following data-set, compute 40

   (i) Value of stock as on 31.03.2017.

(ii) Departments results

	X (Rs.)	Y (Rs.)	Z (Rs.)
Stock (01.04.2016)	12,000	18,000	6,000
Purchase	73,000	62,000	24,000
Actual Sales	86,250	79,700	37,300
Gross Profit at normal selling price	20%	25%	33½%

During the year certain items are sold at discount reflected in values of sales as:

	X (Rs.)	Y (Rs.)	Z (Rs.)
Sales at Normal Price:	5,000	1,500	500
Sales at Actual Price:	3,750	1,200	300

7. (a) Business Strategic Planning Process requires analysis of Product-Market Expansion Grid. — Analyse. 20

(b) 'Hyatt Hotels excells extraordinary short responses time in answering complaints' — Analyse with help of Service-Quality model. 20

8. (a) A Co. has two plants X, Y. Each plant produces three products A, B, C.

	Plant	**Productions (Nos.)**
Product	X	Y
A	1,500	1,500
B	3,000	1,000
C	2,000	5,000

The demand in a particular month: A–20,000 Nos.; B–40,000 Nos.; C–44,000 Nos.

Operating cost/day in plant X = ₹ 600 and Y = ₹ 400.

How many days each plant has to run in that month so as to minimise production cost, still meeting market demand? (Use graphical method) 20

(b) From the table find out Project Duration and Critical Path, after drawing Net work. 20

Activity	Duration	Inter dependent			
A	2	—	J	3	E, H, I
B	3	—			
C	2	—			
D	3	B			
E	4	C			
F	2	A			
G	3	F			
H	2	D			
I	2	G			

2021

MECHANICAL ENGINEERING

PAPER-I

Time Allowed — 3 Hours *Full Marks — 200*

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

*Answers may be given either in **English** or in **Bengali** but all answers must be in one and same language.*

Answer any five *questions.*

1. Choose the correct answer from the options given: 4×10=40

(i) A weight W is supported by two cables as shown in Figure-1. The tension in the left cable T_1 will be minimum when the value of angle θ is

(a) 0°
(b) 30°
(c) 45°
(d) 60°

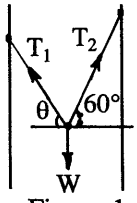


Figure-1

(ii) A system of forces acting on a lamina is shown in Figure-2. The resultant of the force system will meet ABD at

(a) A
(b) B
(c) C
(d) D

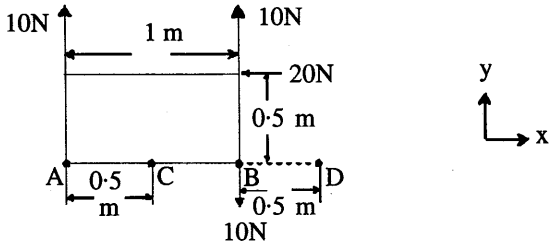


Figure-2

(iii) The state of stress at a point in a loaded member is shown in Figure-3. The magnitude of the maximum shear stress at that point is

(a) 10 MPa
(b) 30 MPa
(c) 50 MPa
(d) 100 MPa

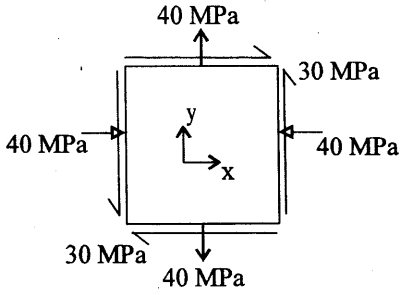


Figure-3

(iv) A beam is hinge-supported at its ends and is loaded as shown in Figure-4. The magnitude of shearing force at a section x of the beam is

(a) P

(b) $\frac{PCx}{L^2}$

(c) $\frac{Px}{2L}$

(d) $\frac{PC}{2L}$

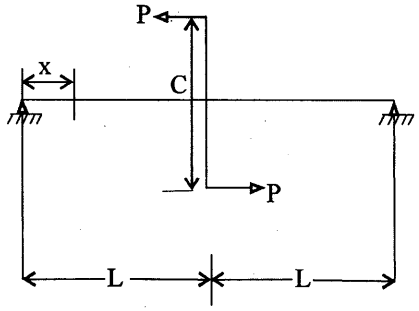


Figure-4

(v) To avoid interference, the maximum length of arc of contact for two externally mating involute gears is

(a) $(r + R)\tan\phi$

(b) $(2r + R)\cot\phi$

(c) $(r + R)\cos\phi$

(d) $(r + R)\sec\phi$

r = pitch circle radius of pinion

R = pitch circle radius of gear

ϕ = pressure angle

(vi) A disc of mass 'm' and radius 'r' is attached to a spring of stiffness 'k'. During its motion the disc rolls on the ground. When released from some stretched position, the centre of the disc will execute simple harmonic motion with a time period of

(a) $2\pi\sqrt{\frac{m}{3k}}$

(b) $2\pi\sqrt{\frac{m}{k}}$

(c) $2\pi\sqrt{\frac{3m}{2k}}$

(d) $2\pi\sqrt{\frac{2m}{k}}$

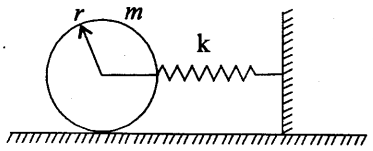


Figure-5

(vii) What is the equivalent stiffness of the system shown in Figure-6?

(a) 24 N/mm

(b) 16 N/mm

(c) 4 N/mm

(d) 8 N/mm

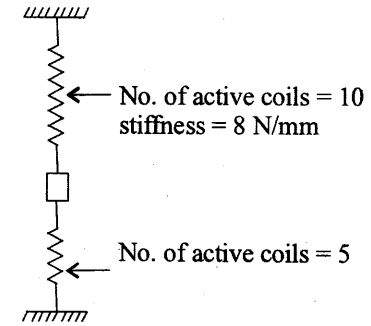


Figure-6

(viii) Match *List-I* with *List-II* and select the correct answer using the codes given below the lists:

List-I	*List-II*
(A) Toughness	(1) Moment area method
(B) Endurance strength	(2) Hardness
(C) Resistance to abrasion	(3) Energy absorbed before fracture in a uni-axial tension test
(D) Deflection in a beam	(4) Fatigue loading

Codes:

	(A)	(B)	(C)	(D)
(a)	(4)	(3)	(1)	(2)
(b)	(4)	(3)	(2)	(1)
(c)	(3)	(4)	(2)	(1)
(d)	(3)	(4)	(1)	(2)

(ix) Interchangeability can be achieved by

(a) standardization

(b) better process planning

(c) better product planning

(d) machining with precision tools

(x) Conversion of temperature in °F from temperature in °C is given by $\frac{C}{5}=\frac{F-32}{9}$. This is programmed in Fortran as follows:

```
write (*,*) 'Enter temperature in degree Celsius'
read (*,*)C
F = (9/5)*C+32
write (*,*)F
stop
end
```

If temperature in degree Celsius is given as 10, the output F of the program will be

(a) 35·00

(b) 42·00

(c) 50·00

(d) 32·00

2. (a) A vertical cylindrical bar of length 3m and cross-sectional area $6{\cdot}25 \times 10^{-4}$ m^2, is fixed at the top and loaded at the bottom by a force P = 360 kN as shown in Figure-7(a). What is the deflection at the end B of the bar due to this loading? The stress-strain diagram for the material of the bar is shown in Figure-7(b).

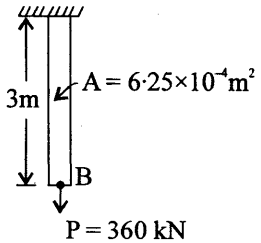


Figure-7(a)

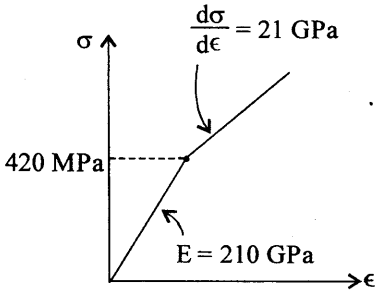
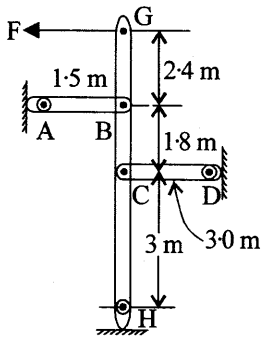


Figure-7(b)

(b) In Figure-8, member GH is taken as perfectly rigid. Members AB and CD are linearly elastic members having modulii of elasticity of 140 GPa and 200 GPa respectively, with equal cross-sectional area of $6{\cdot}25 \times 10^{-4}$ m^2. What are the supporting forces at the pin joint H? Take F = 900 kN. Neglect the weights of the members.



AB = 1·5 m
CD = 3·0 m

Figure-8

20+20=40

3. (a) A beam carrying transverse loads is shown in Figure-9. Draw the shear force and bending moment diagram for the loadings shown. Calculate the maximum normal stress developed in the beam, if the cross-sectional area is rectangular with width = 80 mm and depth = 50 mm.

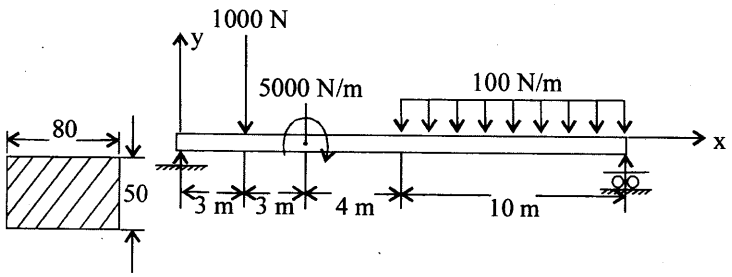


Figure-9

(b) Calculate the maximum deflection of the beam shown in Figure-10. Take modulus of elasticity of the material of the beam = 200 GPa. 20+20=40

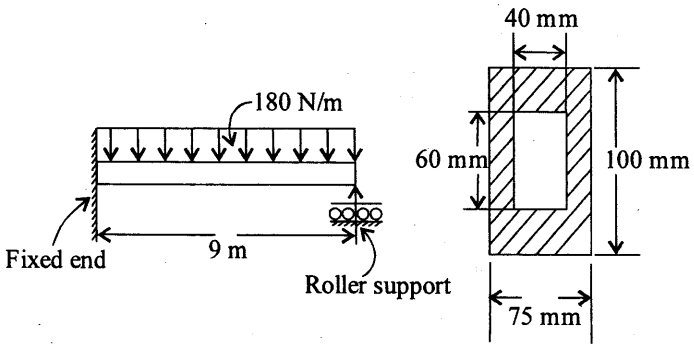


Figure-10

4. (a) The torque exerted on the crankshaft of an engine is given by

$T(N.m) = 10500 + 1620 \sin 2\theta - 1340 \cos 2\theta$,

where θ is the crank angle displacement from the inner dead centre.

Assuming the resistive torque to be constant, determine

(i) the power of the engine when the mean speed is 150 rpm,

(ii) the moment of inertia of the flywheel if the speed variation is not to exceed ± 0·5% of the mean speed, and

(iii) the angular acceleration of the flywheel when the crank has turned through 30° from the inner dead centre.

(b) Two 20° involute spur gears mesh externally and have a gear ratio equal to 2. The module is 10 mm. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine (i) the addendum of each gear, (ii) length of the path of contact, (iii) length of the arc of contact, and (iv) contact ratio. Number of teeth on pinion is 20. 20+20=40

5. (a) A shaft is rotating at a uniform angular speed. Four masses of 300 kg, 450 kg, 360 kg and 390 kg respectively are rigidly attached to the shaft. The masses are rotating in the same plane. The corresponding radii of rotation are 200 mm, 150 mm, 250 mm and 300 mm respectively. The angles made by these masses with horizontal are 0°, 45°, 120° and 255° respectively. Calculate

(i) the magnitude of the balancing mass, and

(ii) the position of the balancing mass if its radius of rotation is 200 mm.

(b) What do you mean by 'logarithmic decrement'? Find an expression for logarithmic decrement in terms of damping factor.

(c) In a single-degree damped vibrating system, a suspended mass of 3·75 kg makes 12 oscillations in 7 seconds when disturbed from equilibrium position. The amplitude of vibration reduces to 0·33 times of its initial value after 4 oscillations.
Determine:

(i) Stiffness of the spring
(ii) Logarithmic decrement
(iii) Damping factor
(iv) Damping coefficient 15+10+15=40

6. (a) Distinguish between orthogonal cutting and oblique cutting.

(b) Discuss briefly the continuous chip with built-up edge.

(c) In a machining operation that approximates orthogonal cutting, the cutting tool has a rake angle of 10°. The depth of cut is 0·5 mm and the chip thickness after the cut is 1·125 mm. Calculate the shear plane angle and the shear strain in the operation. If you use any formula then prove it.

(d) For the machining operation mentioned in part (c) above, the cutting force and thrust force are measured as 1559 N and 1271 N respectively. The width of the cutting operation is 3 mm. Calculate the shear strength of the work material and the corresponding friction angle. Also calculate the friction angle for minimum energy consumption rate.

(e) Following are the two observations made in respect of tool life:

Number	Cutting speed (m/min)	Tool life (min)
1	100 m/min	41 min
2	160 m/min	5 min

From the two data above, derive the Taylor's tool life equation. 6+8+8+10+8=40

7. (a) Consider the following problem involving activities from A to J:

Activity	Immediate predecessor(s)	Duration (Months)
A	–	1
B	A	4
C	A	2
D	A	2
E	D	3
F	D	3
G	E	2
H	F, G	1
I	C, H	3
J	B	2

(i) Construct the CPM network.

(ii) Determine the earliest start times.

(iii) Determine the latest finish times.

(iv) Determine the critical path.

(v) Compute total floats and free floats for non-critical activities.

(b) The area of a triangle can be calculated by the formula, area = $\sqrt{s(s-a)(s-b)(s-c)}$, where a, b, c are the side-lengths and $s = \frac{a+b+c}{2}$. The triangle is feasible only when sum of any two side-lengths is greater than the third.

Write a Fortran program to read three side-lengths of a triangle interactively and calculate and print the area. Before calculating the area, the program must check for feasibility of the triangle with the input side-lengths and print appropriate messages. The program must abort itself in case of infeasibility of the triangle. 20+20=40