**Roll No. .....**

| Question Booklet Number |
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**O. M. R. Serial No.**

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# M. Sc. (Microbiology) (Second Semester)

# EXAMINATION, 2022-23

## BACTERIAL METABOLISM & PHYSIOLOGY

| Paper Code | | | | | | | | | | | | | | | |
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| L | 0 | 4 | 0 | 8 | 0 | 1 | T | / | M | I | C | 2 | 0 | 0 | 1 |

| Questions Booklet Series |
|---|
| A |

*Time : 1:30 Hours* ] [ *Maximum Marks : 75*

**Instructions to the Examinee :**

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

**(Remaining instructions on the last page)** (शेष निर्देश अन्तिम पृष्ठ पर)

***(Only for Rough Work)***

1. Carrier protein takes part in :

(A) Water transport

(B) Active transport of ions

(C) Passive diffusion of molecules

(D) None of the above

2. Which of the following is energy independent ?

(A) Active transport

(B) Primary active transport

(C) Secondary active transport

(D) Passive transport

3. Gene expression in *nif* operons is dependent on :

(A) RNA polymerase σ54 factor

(B) Nif A and Nif L

(C) Only (B)

(D) Both (A) and (B)

4. Which of the following is not an accessory pigment ?

(A) Chlorophyll a

(B) Beta-carotene

(C) Xanthophyll

(D) Lutein

5. Which of the following acts as a chemical reductant in bacterial photosynthesis ?

(A) oxygen

(B) water

(C) hydrogen suiphide

(D) ammonia

6. Where are bacteriochlorophyll present in the cell ?

(A) chloroplast

(B) cytoplasm

(C) mitochondria

(D) membrane

7. Which of the following is incorrect regarding freeliving diazotrophs protection of the oxygen-sensitive nitrogenase enzyme ?

(A) Leghemoglobin synthesis

(B) High rates of respiration

(C) Synthesis of secondary Fe-proteins

(D) The formation of heterocysts

8. Which of the following is involved in the activation of RuBisCO ?

(A) $Ca^{++}$

(B) $K^{+}$

(C) $Zn^{++}$

(D) $Mg^{++}$

9. Membrane proteins :

(A) lower the activation energy for transport

(B) act as enzyme

(C) involve in passive diffusion

(D) always require energy

10. Siderophores chelates :

(A) Ferric ion

(B) Ferrous ion

(C) Both ferric and ferrous ion

(D) None of the above

11. Bacteriorhodopsin functions as :

(A) Photosynthetic pigment

(B) Light-driven proton pump

(C) Photoreceptors

(D) Both (A) and (C)

12. The first compound formed during Calvin cycle is :

(A) RuBP

(B) 3-phosphoglycerate

(C) 3-phosphoglyceraldehyde

(D) $CO_2$

13. How many different types of nitrogenase enzyme complexes are involved in the biological conversion of di-nitrogen to ammonia ?

(A) Three

(B) Four

(C) Five

(D) Six

14. Which of the following acts as electron donor of photosynthesis in cyanobacteria ?

(A) oxygen

(B) water

(C) hydrogen sulphide

(D) ammonia

15. Acetyl CoA enzyme pathway found in :

(A) methanogens

(B) sulfate reducers

(C) acetogenic bacteria

(D) All of the above

16. Lux operon involves :

(A) *LuxICDABE*

(B) *Lux CDABE*

(C) *LuxCDABE*

(D) *LuxAB*

17. PEP-PTS requires :

(A) Protons

(B) ATP

(C) Phosphoenolpyruvate

(D) All of the above

18. A product or products of glycolysis is/are :

(A) ATP

(B) $H_2O$

(C) $CO_2$

(D) Both (A) and (B)

19. The enzyme luciferase produces bioluminescence when $FMNH_2$ and fatty aldehyde react chemically with :

(A) Hydrogen

(B) Oxygen

(C) Methane

(D) Carbon dioxide

20. The $FADH_2$ formed during the TCA cycle enters the electron transport system at which site ?

(A) NADH dehydrogenase

(B) cytochrome

(C) coenzyme Q

(D) ATP synthase

21. Which is the source of the energy used to make ATP by oxidative phosphorylation ?

(A) Oxygen

(B) high-energy phosphate bonds

(C) the proton motive force

(D) $P_i$

22. The cytochrome *d* branch of ETS :

(A) functions at low oxygen level

(B) works during exponential phase

(C) functions at high oxygen level

(D) actively pump protons

23. Which of the following are functions of phosphates used in the preparation of media ?

(A) they act as buffer

(B) source of phosphorous

(C) act as "reserve alkali"

(D) they act as buffer and is a source of phosphorous

24. Which molecule typically serves as the final electron acceptor during fermentation ?

(A) oxygen

(B) $NAD^+$

(C) pyruvate

(D) $CO_2$

25. Which one of the following is the one having highest reduction potential ?

(A) Ubiquinone

(B) $O_2$

(C) FMN

(D) NAD

26. ATP synthase involves in :

(A) Synthesis of ATP

(B) Hydrolysis of ATP

(C) Only (A)

(D) Both (A) and (B)

27. ED pathway first reported in :

(A) *Pseudomonas saccharophila*

(B) *Bacillus subtilis*

(C) *Salmonella typhimurium*

(D) *Xanthomonas campestris*

28. Which of the following enzymes acts in the pentose phosphate pathway ?

(A) 6-phosphogluconate dehydrogenase

(B) Aldolase

(C) Glycogen phosphorylase

(D) PFK-1

29. Methanogens do not produce :

(A) $CO_2$

(B) $CO_2 + CH_4$

(C) $CH_4$

(D) $O_2$

30. Which of the following are capable of reducing inorganic compounds such as iron, nitrogen and sulfur ?

(A) Chemolithoautotrophs

(B) Chemolithotrophic autotrophs

(C) Photoautotrophs

(D) Both (A) and (B)

31. Find the incorrect match of enzymes with its substrates :

(A) Hexokinase-glucose

(B) Pyruvate kinase-Phospho-enol pyruvate

(C) Enolase-Pyruvate

(D) Aldolase-Fructose-1,6 bisphosphate

32. Which of the following describes an active transportation characteristic ?

(A) Uphill process

(B) Require energy

(C) Against electrochemical gradient

(D) All of the above

33. At low ammonia concentrations, the main pathway for ammonia incorporation involves :

(A) Glutamate dehydrogenase

(B) Alanine dehydrogenase

(C) Glutamine synthetase and glutamate synthase

(D) Glutamate synthase

34. Which of the following is not a co-enzyme ?

(A) NAD

(B) NADP

(C) FAD

(D) $Mn^{++}$

35. Which of the following statements is NOT true ?

(A) HMP shunt stands for hexose monophosphate shunt

(B) HMP shunt does not generate $CO_2$

(C) HMP does not generate ATP

(D) pentose phosphate pathway takes place in cytosol

36. ..... accepts Hydrogen from Malate.

(A) FAD

(B) NAD

(C) NADP

(D) FMN

37. *Paracoccus denitrificans* electron transport chain :

(A) having anaerobic transport chain

(B) having aerobic transport chain

(C) having both aerobic and anaerobic transport chain

(D) None of the above

38. The rate limiting step of Calvin cycle is catalyzed by which enzyme ?

(A) RuBisCO

(B) Phosphoglycerate kinase

(C) Ribose phosphate isomerase

(D) Transketolase

39. Which of the following about the impact of nitrogen supplies on the nitrogenase enzyme complex is incorrect ?

(A) Transcriptional regulation controls the synthesis of the nitrogenase enzyme.

(B) The Fe protein is reversibly inactivated by ADP-ribosylation.

(C) Mo-Fe protein is reversibly deactivated by ADP-ribosylation.

(D) Interfering with the supply of reductant to nitrogenase

40. Gibbs-Donnan effect leads to :

(A) Non-diffusible ions between 2 sides will be equal

(B) Diffusible ions between 2 sides will be equal

(C) Equal concentrations of ions on both sides

(D) Osmotic gradient

41. Which of the following is the correct sequence of electron acceptors in ETS for production of ATP ?

(A) Cyt b, c, a, $a_3$

(B) Cyt a, a, b, c

(C) Cyt c, b, a, $a_3$

(D) Cyt b, c, $a_3$, a

42. Oxidative phosphorylation results in the formation of :

(A) Oxygen

(B) ADP

(C) ATP + $H_2O$

(D) NADH

43. Gases such as carbon dioxide and oxygen cross the cell membrane by :

(A) Primary active transport

(B) Secondary active transport

(C) Passive diffusion through lipid bilayer

(D) Gas transport protein

44. Which statement is correct about ABC transporters ?

(A) use the energy of ATP hydrolysis

(B) can transport amino acids, peptides, sugars

(C) None of the above

(D) Both of the above

45. Which statement is not true for PEP-PTS ?

(A) Phosphorylation of molecule while transportation

(B) Oxidation of molecule while transportation

(C) Involves two enzymes

(D) Heat-stable protein is a part of PEP-PTS

46. What is the dissimilarity between active transport and facilitated diffusion ?

(A) Both face saturation effect

(B) Both requires transporters

(C) Glucose molecule can be transported

(D) Both requires ATP

47. Secondary active transport depends upon :

(A) ATP

(B) $H^+$ and $Na^+$ gradient

(C) NADH

(D) $FMNH_2$

48. Which of the following is a chlorophyll molecule lacking central $Mg^{2+}$ ion ?

(A) Chla

(B) Bacteriochlorophyll

(C) Chlc

(D) Pheophytin

49. Name the physiochemical process in which chemical energy is produced by light energy :

(A) Photosynthesis

(B) Respiration

(C) Oxidative decarboxylation

(D) Oxidative phosphorylation

50. Cyclic photophosphorylation results in the formation of :

(A) ATP

(B) NADPH

(C) ATP + NADPH

(D) ATP + NADPH and $O_2$

51. Reduction of NADP occurs in :

(A) Oxidative photophosphorylation

(B) Cyclic photophosphorylation

(C) Non cyclic photophosphorylation

(D) None of the above

52. In what case, the transporters are known as antiporters ?

(A) when 2 substances move in same direction

(B) when 2 substance move in same direction and 1 in opposite

(C) when 3 substances move in same direction

(D) when 2 substances move in opposite direction

53. Electrochemical gradient exists whenever there is :

(A) A net difference in charges

(B) Excess liquids

(C) No. difference in charges

(D) None of the above

54. In EMP pathway, the process by which ATP is formed from ADP is :

(A) Reduction

(B) Oxidative phosphorylation

(C) Substrate-level phosphorylation

(D) Photophosphorylation

55. The Reactive Oxygen Species (ROS) produced by some bacteria are degraded by which of the following enzymes ?

(A) Peroxidase

(B) Lyase

(C) Catalase

(D) Superoxide dismutase, Catalase and Peroxidase

56. Drastic variations in cytoplasmic pH can harm microorganisms by :

(A) disrupting the plasma membrane

(B) inhibiting the activity of enzymes

(C) inhibiting the activity of transport proteins

(D) All of the above

57. What is not correct about the pho Regulon ?

(A) involve in conservation and management of inorganic phosphate

(B) controlled by a two-component regulatory system

(C) Pho Regulon is Involved in Pathogenesis

(D) None is true

58. Nitrogenase can reduce a variety of molecules other than $N_2$ :

(A) Acetylene

(B) Cyanide

(C) None of the above

(D) Both (A) and (B)

59. Cleavage of Fructose 1, 6-biophosphate yields :

(A) Two aldoses

(B) Two ketoses

(C) An aldose and a ketose

(D) Only a ketose

60. A number of pressures may have selected for multicellularity, including :

(A) physicochemical stress

(B) nutrient scarcity

(C) predation

(D) All of the above

61. Which statement is not true about nitrifying bacteria ?

(A) Biological ammonia oxidation to nitrate

(B) Reduction of nitrate to ammonia

(C) Use proton motive force to reverse the flow of electrons and reduce NAD

(D) Make ATP by oxidative phosphorylation

62. Which prokaryotes are characterised by having relatively high concentrations of sterols ?

(A) Sulfur oxidizing bacteria

(B) Cyanobacteria

(C) Methane oxidizing bacteria

(D) Nitrifying bacteria

63. Sulfur-oxidizing chemolithotrophs are unable to oxidise :

(A) $SO_4^{2-}$

(B) $SO_3^-$

(C) $S^0$

(D) $H_2S$

64. Which of the following claims about photosystems is true ?

(A) Photosystems are arrangements of chlorophyll and other pigments packed into membrane.

(B) Only one photosystem is involved in anoxygenic photosynthesis.

(C) Both (A) and (B) are true

(D) Only (A) is accurate

65. On which surface of cell, Donnan equilibrium occurs ?

(A) Cell Wall

(B) Plasma membrane

(C) Outer memberane

(D) Nuclear membrane

66. Mesophiles are group of bacteria that grow within the temperature range of :

(A) 0-20 degree Celsius

(B) 25-40 degree Celsius

(C) 45-60 degree Celsius

(D) more than 60 degree Celsius

67. Quorum sensing autoinducers primarily produced by Gram negative bacteria :

(A) 2-alkyl-4(1H) quinolones

(B) dihydroxypentanedione

(C) N-acylhomoserine lactones

(D) All of the above

68. How many molecules of $CO_2$ are produced from pyruvate when NAD and FAD are reduced to NADH and $FADH_2$, respectively ?

(A) Four

(B) Six

(C) Three

(D) Two

69. Hydrogen-oxidizing microorganism :

(A) Can oxidize hydrogen gas to produce energy

(B) Donate electrons either to an electron transport chain or to NAD, depending on the hydrogenase

(C) Only (A)

(D) Both (A) and (B)

70. One glucose molecule is generated during the Calvin cycle from :

(A) $6CO_2 + 18ATP + 12NADPH$

(B) $6CO_2 + 18ATP + 30NADPH$

(C) $6CO_2 + 30ATP + 12NADPH$

(D) $6CO_2 + 12ATP$

71. Which of the following is an anoxygenic photosynthetic organism ?

(A) Plants

(B) Photosynthetic protists

(C) Cyanobacteria

(D) Green and Purple photosynthetic organism

72. Anoxygenic photosynthetic bacteria are :

(A) Photoautotrophs

(B) photoheterotrophs

(C) Detritivores

(D) Omnivores

73. The process by which fat is converted to carbs in plants and some microbes is :

(A) Acetyl CoA pathway

(B) Glyoxylate cycle

(C) Gluconeogenesis

(D) Kreb's cycle

74. What procedures are utilised to grow anaerobes in a lab ?

(A) medium containing reducing agents like thioglycollate or cysteine

(B) nitrogen gas flushing to remove $O_2$

(C) Both (A) and (B)

(D) None of the above

75. Electrons from the excited chlorophyll molecules of PS-II are first accepted by :

(A) Pheophytin

(B) Ferredoxin

(C) Cytochrome f

(D) Cytochrome b

76. In assimilatory nitrate reduction, nitrate is ultimately reduced to :

(A) Ammonia

(B) Nitric oxide

(C) Nitrite

(D) Nitrous oxide

77. Methanogens belong to :

(A) Eubacteria

(B) Dinoflagellates

(C) Slime moulds

(D) Archaebacteria

78. High intracellular quantities of the following substances do not interfere with development or metabolism :

(A) Potassium ions

(B) Mannitol, arabitol, and glycerol

(C) All of the above

(D) None of the above

79. Which of the following is required for the action of the nitrogenase enzyme ?

(A) Light

(B) High input of energy

(C) Super oxygen radicals

(D) $Mn^{2+}$

80. Which of the following is the Complex V of ETS ?

(A) NADH dehydrogenase

(B) Cytochrome $aa_3$

(C) Cytochrome $bc_1$

(D) ATP synthase

81. Fe protein of nitrogenase enzyme is a product of :

(A) *nif* H

(B) *nif* D

(C) *nif* K

(D) *nif* A

82. Ammonia is assimilated through :

(A) Glutamate

(B) Glutamine

(C) Alanine

(D) All of the above

83. Role of quorum sensing is to determine :

(A) the size of the population

(B) population density-dependent changes in behaviour

(C) the speed of water flow

(D) the density of the population

84. Iron-transport molecules are :

(A) Hydroxamates

(B) Catecholates

(C) Both (A) and (B)

(D) None of the above

85. The inhibition of alcoholic fermentation in the presence of oxygen is known as :

(A) Pasteur effect

(B) Louis effect

(C) Homolactic fermentation

(D) Glycolysis

86. Instead of –CH group at the third C of the side group of Chla, Chlb has :

(A) –COOH group

(B) –CO group

(C) –CHO group

(D) –OH group

87. Assimilative nitrate reduction takes place in :

(A) Prokaryotes only

(B) Prokaryotes and plants only

(C) Prokaryotes, fungi and plants only

(D) Prokaryotes, fungi, plants and animals

88. Rotational catalysis explains the mechanism of :

(A) NADH synthesis

(B) Electron transport

(C) ATP synthesis

(D) Transport system

89. The activity of this enzyme increases when the ATP supply of a cell depletes :

(A) Phosphofructokinase-l

(B) Hexokinase

(C) Glucokinase

(D) Pyruvate kinase

90. The enzyme responsible for production of pyruvate and glyceraldehde 3-phosphare :

(A) 6-phosphogluconate dehydratase

(B) KDPG aldolase

(C) glucose-6-phosphate dehydrogenase

(D) PEP kinase

91. Assimilatory sulfate reduction differs from dissimilatory sulfate reduction in :

(A) involves sulfate activation through the formation of phosphoadenosine 5'-phosphosulfate

(B) restricted to sulfate reducing bacteria

(C) Both of the above

(D) None of the above

92. Methanogenic archaea have high practical significance because :

(A) Methane is a greenhouse gas because it absorbs infrared light.

(B) A major impact on iron corrosion.

(C) Methanogenesis can potentially pose a threat to the environment.

(D) All of the above

93. Workthroughs of N-Acyl L-Homoserine Lactones :

(A) Cytoplasmic receptor binding to cause altered gene expression.

(B) Two-component histidine kinase receptor detection.

(C) Both of the above

(D) None of the above

94. Most fungi prefer pH range :

(A) pH 4 to 6

(B) pH 7 to 9

(C) pH 0 to 5

(D) pH 8 to 11

95. Glycolysis can occur in ..... .

(A) anaerobic cells

(B) aerobic cells

(C) Neither aerobic and anaerobic cells

(D) Both aerobic and anaerobic cells

96. Which among the following is not an ammonia-oxidizing bacteria ?

(A) *Nitrospira gracilis*

(B) *Nitrosococcus oceanus*

(C) *Nitrosomonas europaca*

(D) *Nitrosovibrio tenuis*

97. PEP-PTS is an example of :

(A) Group translocation

(B) Primary active transport

(B) Secondary active transport

(D) Facilitated diffusion

98. Which cofactor involves in methanogenesis ?

(A) NAD

(B) $Fe^{++}$

(C) $H_4MPT$

(D) All of the above

99. The statement correct about rTCA cycle :

(A) Key enzymes are ATP citrate lyase, $\alpha$-ketoglutarate synthase, fumarate reductase

(B) It is a reductive pathway.

(C) Pathway present in Archaea

(D) All of the above

100. The order of three steps of Calvin cycle is :

(A) Regeneration-Carboxylation-Reduction

(B) Carboxylation-Regeneration-Reduction

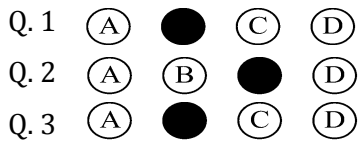
(C) Carboxylation-Reduction-Regeneration

(D) Reduction-Regeneration-Carboxylation

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

**Example :**

**Question :**




Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

**Impt. :** On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is ny discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर— A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :




अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।