

Indira Gandhi National Open University School of Sciences

MZO-003 COMPARATIVE ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Block	
1	
FUNDAMENTALS OF ANIMAL PHYSIOLOGY	,
UNIT 1	
Circulatory System	9
UNIT 2 THE PEOP	
Respiratory System	33
UNIT 3 EPS	
Osmoregulation and Excretion	56
UNIT 4	
Muscle Physiology	93
UNIT 5	
Feeding Systems and Digestion	125

COURSE NAME: COMPARATIVE ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Course Design Committee

Prof. Sujatha Varma Former Director, School of Sciences, IGNOU, Maidan Garhi New Delhi-110068

Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007

Prof. Sarita Kumar Department of Zoology, Acharya Narender Dev College, University of Delhi, Delhi-110007

Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021 Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004

Prof. Devinder Kaur Kochar Department of Zoology Punjab Agricultural University Ludhiana-141004

Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007

Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University, Sector-43 Faridabad Haryana-121004 Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Prof. Neera Kapoor School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

Prof. Neera Kapoor (Units 1, 2, 3, 4 and 5) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Programme Coordinators	:	Prof. Neera Kapoor and Dr. Siya Ram
Course Coordinator	:	Prof. Neera Kapoor
Course Editor	:	Dr. Anjali Nawani Sri Venkateswara College, University of Delhi Delhi-110021
Production	:	Mr. Hemant Kumar SO(P), MPDD, IGNOU

Acknowledgement:

- Prof. Neera Kapoor and Mr. Ajit Kumar, Suggestions for figures and Cover Design.
- Mr. Vikas Kumar, JAT for word processing and CRC preparation.
- Some of the units material has been taken from IGNOU course material.

August, 2023

© Indira Gandhi National Open University, 2023

ISBN:

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at:



Indira Gandhi National Open University School of Sciences

MZO-003 COMPARATIVE ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Block

2	
SENSING THE ENVIRONMENT AND COORDINATION	
UNIT 6	
Nervous System TLE DE D	175
UNIT 7	
Environment Stress and Thermoregulation	206
UNIT 8	
Environment Sensing Receptors	226
UNIT 9	
Adaptive Behaviour (Coloration and Bioluminescence)	254
UNIT 10	
Electric Organs and Electroreception	285

COURSE NAME: COMPARATIVE ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Course Design Committee

Prof. Sujatha VarmaPrFormer Director, School ofDoSciences, IGNOU, Maidan GarhiUiNew Delhi-110068Ja

Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007

Prof. Sarita Kumar Department of Zoology Acharya Narender Dev College University of Delhi, Delhi-110007

Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021 Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004

Prof. Devinder Kaur Kochar Department of Zoology Punjab Agricultrual University Ludhiana-141004

Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007

Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University Sector-43 Faridabad, Haryana-121004 Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Prof. Neera Kapoor School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

S	or. Anjali Nawani ri Venkateswara College, University of Delhi velhi-110021
1	Prof. Neera Kapoor and Dr. Siya Ram
:	Prof. Neera Kapoor
:	Dr. Anjali Nawani Sri Venkateswara College, University of Delhi Delhi-110021
:	Mr. Hemant Kumar SO(P), MPDD, IGNOU
	S D :

Acknowledgement:

- Prof. Sarita Kumar (Professor in Zoology, ANDC, University of Delhi) for her useful comments on Unit 10.
- Prof. Neera Kapoor and Mr. Ajit Kumar, Suggestions for figures and Cover Design.
- Mr. Vikas Kumar, JAT for word processing and CRC preparation.
- Some of the units material has been taken from IGNOU course material.

August, 2023

© Indira Gandhi National Open University, 2023

ISBN:

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at:



MZO-002 GENETICS AND ANIMAL BIOTECHNOLOGY

Indira Gandhi National Open University School of Sciences

Block



HUMAN GENES AND INHERITANCE

UNIT 9	
Sex Linked Inheritance	9
UNIT 10	
Human Genetics and Chromosomal Abnormalities	D 33 'S
UNIT 11	
Genetic Analysis of Quantitative Traits	78

Course Design Committee

Prof. Sujatha Varma Former Director, School of Sciences, IGNOU, Maidan Garhi New Delhi-110068

Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007

Prof. Sarita Kumar Department of Zoology, Acharya Narender Dev College, University of Delhi, Delhi-110007

Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021 Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004

Prof. Devinder Kaur Kochar Department of Zoology, Punjab Agricultural University Ludhiana-141004

Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007

Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University, Sector-43, Faridabad Haryana-121004 Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Prof. Neera Kapoor School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

Dr. Pooja Arora Department of Zoology, Hansraj College, University of Delhi Delhi-110007 (Unit 9)

Dr. Neelam Gandhi (Retd.) Department of Zoology, Hansraj College, University of Delhi Delhi-110007 (Unit 10) Dr. Anjali S. Nawani Department of Zoology Sri Venkateswara College South Campus, University of Delhi, Delhi-110021 (Unit 11) School of Sciences

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 (Unit 9)

Prof. Aryadeep Roy Choudhury School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 (Units 10 and 11)

Programme Coordinators	:	Prof. Neera Kapoor and Dr. Siya Ram
Course Coordinator	:	Dr. Ravi Rajwanshi
Course Editor	:	Dr. Ajay Kumar Singh Department of Bioinformatics, Central University of South Bihar, Gaya Panchanpur Road, Fathepur Tekari Gaya-824236
Production	:	Mr. Rajiv Girdhar Assistant Registrar, MPDD, IGNOU

Acknowledgement:

- Dr. Ravi Rajwanshi and Prof. Aryadeep Roy Choudhury, suggestions for figures.
- Dr. Ravi Rajwanshi and Mr. Ajit Kumar, for cover design.
- Mr. Vikas Kumar, JAT for CRC preparation.

May, 2024

© Indira Gandhi National Open University, 2024

ISBN: 978-93-6106-531-6

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at : Dee Kay Printers, 5/37 A, Kirti Nagar Industrial Area, New Delhi - 110015



MZO-002 GENETICS AND ANIMAL BIOTECHNOLOGY

Indira Gandhi National Open University School of Sciences

Block	
1	
GENE INTERACTION AND MAPPING	
UNIT 1	
Mendel's Laws	11
UNIT 2	
Gene Action and Interactions	P 45 S
UNIT 3	
Gene Structure and Function	91
UNIT 4	
Linkage, Crossing Over and Mapping in Eukaryote	s 109

Course Design Committee

Prof. Sujatha Varma Former Director, School of Sciences, IGNOU, Maidan Garhi New Delhi-110068

Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007

Prof. Sarita Kumar Department of Zoology, Acharya Narender Dev College, University of Delhi, Delhi-110007

Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021 Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004

Prof. Devinder Kaur Kochar Department of Zoology, Punjab Agricultural University Ludhiana-141004

Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007

Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University, Sector-43, Faridabad Haryana-121004 Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Prof. Neera Kapoor School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

Dr. Neelam Gandhi (Retd.) Department of Zoology, Hansraj College, University of Delhi, Delhi-110007 (Units 1 and 2)

Dr. Anjali S. Nawani Department of Zoology Sri Venkateswara College South Campus, University of Delhi, Delhi-110021 (Unit 3) Dr. Pooja Arora Department of Zoology, Hansraj College, University of Delhi, Delhi-110007 (Unit 4)

Dr. Bhupinder Dhir Ex-Consultant, School of Sciences, IGNOU, Maidan Garhi, New Delhi-110068 (Unit 1) School of Sciences

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 (Units 1, 2 and 3)

Prof. Aryadeep Roy Choudhury School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 (Unit 4)

Programme Coordinators	:	Prof. Neera Kapoor and Dr. Siya Ram
Course Coordinator	:	Dr. Ravi Rajwanshi
Course Editor	:	Prof. Antresh Kumar Professor, Department of Biochemistry Central University of Haryana, Jant-Pali, Mahendergarh Haryana-123029
Production	:	Mr. Rajiv Girdhar Assistant Registrar, MPDD, IGNOU

Acknowledgement:

• Dr. Ravi Rajwanshi and Prof. Aryadeep Roy Choudhury, suggestions for figures.

• Dr. Ravi Rajwanshi and Mr. Ajit Kumar, for cover design.

• Mr. Vikas Kumar, JAT for CRC preparation.

May, 2024

© Indira Gandhi National Open University, 2024

ISBN: 978-93-6106-100-4

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at : Dee Kay Printers, 5/37 A, Kirti Nagar Industrial Area, New Delhi - 110015



MZO-001 MOLECULAR CELL BIOLOGY

Indira Gandhi National Open University School of Sciences

Block		
3		
CELL CYCLE AND CELL CULTURE		
UNIT 9		
Cell Cycle	7	
UNIT 10 THE PEOP	F'S	
Cell Cycle Regulation	31	
UNIT 11		
Intracellular Protein Turnover	52	
UNIT 12		
Animal Cell Culture	63	

COURSE NAME: MOLECULAR CELL BIOLOGY

Course Design Committee

Prof. Sujatha Varma Former Director, School of Sciences, IGNOU, Maidan Garhi New Delhi-110068	Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004	Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 Prof. Neera Kapoor
Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007	Prof. Devinder Kaur Kochar Department of Zoology, Punjab Agricultural University	School of Sciences, IGNOU Maidan Garhi, New Delhi-110068
Prof. Sarita Kumar Department of Zoology, Acharya Narender Dev College, University of Delhi, Delhi-110007 Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021	Ludhiana-141004 Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007 Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University, Sector-43, Faridabad Haryana-121004	Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

College, University of Delhi, New Delhi-110049 (Units 11 and 12) Delhi-110049 (Units 11 and 12)		Maidan Garhi, New Delhi-110068 n Sharma (Unit 12) of Zoology, Gargi Dr. Siya Ram
--	--	--

Programme Coordinators		Prof. Neera Kapoor and Dr. Siya Ram
Course Coordinators	:	Prof. Aryadeep Roy Choudhury and Dr. Siya Ram
Course Editor	:	Prof. Ram Naraian Department of Biotechnology, Faculty of Science, Veer Bahadur Singh, Purvanchal University Jaunpur-222003
Production	:	Mr. Tilak Raj Assistant Registrar, MPDD, IGNOU, New Delhi

Acknowledgement:

- Prof. Aryadeep Roy Choudhury, Dr. Siya Ram and Mr. Ajit Kumar, Suggestions for figures and cover design.
- Mr. Manoj Kumar and Mr. Vikas Kumar for word processing and CRC preparation.

May, 2024

© Indira Gandhi National Open University, 2024

ISBN : 978-93-6106-192-9

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at : Educational Stores, S-5 Bulandshahar Road, Indl. Area Site-1 Ghaziabad (U.P.)

COURSE CODE: MZO-001



MZO-001 MOLECULAR CELL BIOLOGY

Indira Gandhi National Open University School of Sciences

Block

4	
CELL JUNCTIONS AND COMMUNICATIONS	;
UNIT 13	
Extracellular Matrix and Cell Junctions	87
UNIT 14	
Signal Transduction	104
UNIT 15	
Cell Surface Receptors	123
UNIT 16	
Cell Death and Renewal	143

COURSE NAME: MOLECULAR CELL BIOLOGY

Course Design Committee

Prof. Sujatha Varma Former Director, School of Sciences, IGNOU, Maidan Garhi New Delhi-110068

Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007

Prof. Sarita Kumar Department of Zoology, Acharya Narender Dev College, University of Delhi, Delhi-110007

Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021 Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004

Prof. Devinder Kaur Kochar Department of Zoology, Punjab Agricultural University Ludhiana-141004

Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007

Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University, Sector-43, Faridabad Haryana-121004 Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Prof. Neera Kapoor School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

Dr. Anjali S. Nawani Department of Zoology, Sri Venkateswara College, University of Delhi, Delhi-110021 (Units 13, 14 and 15)

Dr. Roopa R Samal Department of Zoology, Dyal Singh College, University of Delhi Delhi-110003 (Unit 13) Prof. Indrakant K. Singh Department of Zoology, Deshbandhu College, University of Delhi, Delhi-110019 (Unit 16)

School of Sciences

Prof. Aryadeep Roy Choudhury School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 (Units 13, 14, 15 and 16)

Programme Coordinators	:	Prof. Neera Kapoor and Dr. Siya Ram
Course Coordinators	:	Prof. Aryadeep Roy Choudhury and Dr. Siya Ram
Course Editor	:	Prof. Ram Naraian Department of Biotechnology, Faculty of Science, Veer Bahadur Singh, Purvanchal University Jaunpur-222003
Production	:	Mr. Tilak Raj Assistant Registrar, MPDD, IGNOU, New Delhi

Acknowledgement:

- Prof. Aryadeep Roy Choudhury, Dr. Siya Ram and Mr. Ajit Kumar, Suggestions for figures and cover design.
- Mr. Manoj Kumar and Mr. Vikas Kumar for word processing and CRC preparation.

May, 2024

©Indira Gandhi National Open University, 2024

ISBN : 978-93-6106-192-9

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at : Educational Stores, S-5 Bulandshahar Road, Indl. Area Site-1 Ghaziabad (U.P.)

COURSE CODE: MZO-001



MZO-001 MOLECULAR CELL BIOLOGY

Indira Gandhi National Open University School of Sciences

Block	
2	
CELL TRANSPORT	
UNIT 5	
Biology of Membrane and Transport of lons	81
UNIT 6	
Transepithelial Transport	102
UNIT 7	
Bulk Transport	132
UNIT 8	
Neurotransmitters Secretion	163

COURSE NAME: MOLECULAR CELL BIOLOGY

Course Design Committee

Prof. Sujatha Varma Former Director, School of Sciences, IGNOU, Maidan Garhi New Delhi-110068

Prof. Neeta Sehgal Department of Zoology University of Delhi, Delhi-110007

Prof. Sarita Kumar Department of Zoology, Acharya Narender Dev College, University of Delhi, Delhi-110007

Prof. S. Dinakaran Department of Zoology Madurai Kamaraj University Tamil Nadu-625021 Prof. Bharati Chauhan Department of Zoology University of Rajasthan Jaipur-302004

Prof. Devinder Kaur Kochar Department of Zoology, Punjab Agricultural University Ludhiana-141004

Prof. Varsha Wankhade Department of Zoology Savitribai Phule University Pune-411007

Prof. Sarita Sachdeva Department of Biotechnology Manav Rachna International University, Sector-43, Faridabad Haryana-121004 Prof. Amrita Nigam (Retd.) School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Prof. Neera Kapoor School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Dr. Ravi Rajwanshi School of Sciences, IGNOU Maidan Garhi, New Delhi-110068

Block Preparation Team

Dr. Bhupinder Dhir Ex. Consultant Discipline of Life Sciences, SOS IGNOU (Unit 5)	Dr. Anjali S. Nawani Department of Zoology, Sri Venkateswara College, University	tment of Zoology, Sri ateswara College, University hi Delhi-110021 (Unit 8) School of Sciences Prof. Aryadeep Roy Choudhury School of Sciences	
Prof. Varsha Wankhade Department of Zoology, Savitribai Phule Pune University	of Delhi, Delhi-110021 (Unit 8) Dr. Roopa R Samal	Maidan Garhi, New Delhi-110068 (Units 6 and 7)	
Pune-411007 (Units 6 and 7)	Department of Zoology, Dyal Singh College, University of Delhi Delhi-110003 (Unit 8)	Dr. Siya Ram School of Sciences, IGNOU Maidan Garhi, New Delhi-110068 (Units 5 and 8)	

Programme Coordinators	:	Prof. Neera Kapoor and Dr. Siya Ram
Course Coordinators	:	Prof. Aryadeep Roy Choudhury and Dr. Siya Ram
Course Editor	:	Prof. Ram Naraian, Department of Biotechnology, Faculty of Science, Veer Bahadur Singh, Purvanchal University, Jaunpur-222003
Production	:	Mr. Tilak Raj Assistant Registrar, MPDD, IGNOU, New Delhi

Acknowledgement:

- Prof. Aryadeep Roy Choudhury, Dr. Siya Ram and Mr. Ajit Kumar, Suggestions for figures and cover design.
- Mr. Manoj Kumar and Mr. Vikas Kumar for word processing and CRC preparation.

May, 2024

© Indira Gandhi National Open University, 2024 ISBN : 978-93-6106-192-9

All rights reserved. No part of this work may be reproduced in any form, by mimeograph or any other means, without permission in writing from Indira Gandhi National Open University.

Further information on Indira Gandhi National Open University courses may be obtained from the University's office at Maidan Garhi, New Delhi-110 068 or IGNOU website www.ignou.ac.in.

Printed and published on behalf of Indira Gandhi National Open University, New Delhi by the Registrar, MPDD, IGNOU.

Printed at : Educational Stores, S-5 Bulandshahar Road, Indl. Area Site-1 Ghaziabad (U.P.)

COURSE CODE: MZO-001