

**D.P VIPRA P. G. COLLEGE,  
BILASPUR (C.G)**

**(An Autonomous College under UGC Scheme)**

**NAAC ACCREDITED A ISO-9001:2015 APPROVED**

**PH. No. 07752-424497, web- www.dpvipracollege.in, email-  
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**COURSE CURRICULLUM & MARKING SCHEME  
POST GRADUATE COURSE IN MICROBIOOGY  
(AS PER LOCF AND CHOICE BASED CREDIT SYSTEM UNDER NEP  
2020)  
Semester System for Affiliated College**



ESTD: 1969

w. e. f SESSION 2024 -25

**DEPARTMENT OF MICROBIOLOGY  
M. Sc I, II, III & IV SEMESTER  
Program Code DPMS06**

Semester	Course Code	Course Name	Credit			Total Credit	Marks			
			L	T	P		ESE	CIA	Total	
									MAX	MIN
First	MMBT101	General Microbiology and Bacteriology	3	1	-	4	70	30	100	40
	MMBT102	Virology	3	1	-	4	70	30	100	40
	MMBT103	Phycology, Mycology and Protozoology	3	1	-	4	70	30	100	40
	MMBT104	Biochemistry	3	1	-	4	70	30	100	40
	MMBP101	LAB I	-	-	2	2	35	15	50	20
	MMBP102	LAB II	-	-	2	2	35	15	50	20
		<b>Total</b>				<b>20</b>	<b>350</b>	<b>150</b>	<b>500</b>	<b>200</b>
Second	MMBT201	Bioinstrumentation and Biochemical Techniques	3	1	-	4	70	30	100	40
	MMBT202	Microbial Physiology	3	1	-	4	70	30	100	40
	MMBT203	Microbial Genetics and Molecular Biology	3	1	-	4	70	30	100	40
	MMBT204	Agriculture Microbiology	3	1	-	4	70	30	100	40
	MMBP201	LAB I	-	-	2	2	35	15	50	20
	MMBP202	LAB II	-	-	2	2	35	15	50	20
		<b>Total</b>				<b>20</b>	<b>350</b>	<b>150</b>	<b>500</b>	<b>200</b>
Third	MMBT301	Medical and veterinary microbiology	3	1	-	4	70	30	100	40
	MMBT302	Environmental microbiology	3	1	-	4	70	30	100	40
	MMBT303	Biostatistics and bioinformatics	3	1	-	4	70	30	100	40
	MMBT304(A)	Immunology (Elective)	3	1	-	4	70	30	100	40
	MMBT304(B)	Fermentation technology (Elective)	-	-	-	-	-	-	-	-
	MMBT304(C)	Food microbiology (Elective)	-	-	-	-	-	-	-	-
	MMBP301	LAB I	-	-	2	2	35	15	50	20
	MMBP302	LAB II	-	-	2	2	35	15	50	20
		<b>Total</b>				<b>20</b>	<b>350</b>	<b>150</b>	<b>500</b>	<b>200</b>
Fourth	MMBT401	Industrial Microbiology	3	1	-	4	70	30	100	40
	MMBT402	Enzymology	3	1	-	4	70	30	100	40
	MMBT403	Computer Fundamentals and Research Techniques	3	1	-	4	70	30	100	40
	MMBT404(A)	Microbial Ecology (Elective)	3	1	-	4	70	30	100	40
	MMBT404(B)	Intellectual Property Rights (Elective)	-	-	-	-	-	-	-	-
	MMBT404(C)	Plant Pathology and Disease Management (Elective)	-	-	-	-	-	-	-	-
	MMBP401	LAB I	-	-	2	2	35	15	50	20
	MMBP-1D	Project work	-	-	2	2	-	-	50	20
		<b>Total</b>				<b>20</b>	<b>350</b>	<b>150</b>	<b>500</b>	<b>200</b>
		<b>Grand Total</b>				<b>80</b>	<b>1400</b>	<b>600</b>	<b>2000</b>	<b>800</b>

Program Code and Name	<b>DPMS06, M.Sc. (MICROBIOLOGY)</b>			Semester	<b>II</b>
Exam Code and Name	<b>2062 - M. Sc. MICROBIOLOGY SECOND SEMESTER</b>			Paper	<b>I</b>
Course Code	<b>MMBT201</b>			Course Type	<b>T</b>
Course Title	<b>Bioinstrumentation and Biochemical Techniques</b>				
Total Credit	<b>4/3/2/1</b>				
Total Marks	CIA: 30/15	ESE: 70/35	Max Marks: 100/50	Min. Pass. Marks: 40/20	
Prerequisites (if any)	NO				
Course Outcomes	CO1: Understand important instruments and their Suitable employability. CO2: Understand principle, construction and working of important instrument. CO3: Understand application of important instruments. CO4: To learn biochemical techniques.				

<b>Contents of Course</b>		
<b>Unit</b>	<b>Contents</b>	<b>No. of Period</b>
I	<b>Basic laboratory Instruments:</b> Principle and working of pH meter, turbid meter, BOD. Principle, type and application of Autoclave, Laminar Air Flow, Incubator, and Colony counter and Haemocytometer Centrifugation- types of centrifuge machine, methods and their application.	15
II	<b>Microscopy:</b> Basic principles for the examination of microbes by light, dark field, phase contrast, confocal fluorescent and electron (transmission and scanning). <b>Chromatography:</b> Chromatographic techniques: Basic concepts, Gel filtration Chromatography, Ion exchange chromatography, Affinity chromatography, HPLC and FPLC.	15
III	<b>Spectroscopy and Electrophoresis:</b> Spectrophotometry – basic principles, law of absorption and radiation, principles and application of visible, ultraviolet, infrared and mass spectroscopy. Principles and application of Atomic Absorption And Emission spectrophotometer, NMR and ESR. Principle, types and applications of electrophoresis, frontal and zonal electrophoresis, paper, starch gel, polyacrylamide and agarose gel electrophoresis.	15
IV	<b>Biochemical techniques:</b> Extraction, purification, application and analysis of proteins, carbohydrates and lipids. General methods of extraction- salting out, use of organic solvents; Purification; mass determination- GC, MS, and MALDI-TOF: structure determination- X-ray diffraction. DNA analysis- Southern blotting, Northern blotting, Western blotting.	15
Total no. of Lectures		60

Text books	<ul style="list-style-type: none"> <li>Biochemistry, Stryer 6th edition W. H. Freeman 20012. Principles of Biochemistry Lehninger 3rd Edition by Nelson and Cox (Worth) 2000.</li> <li>Voet, D. &amp; Voet, J. G. 2005. Biochemistry, John Wiley and sons. Inc. 3. Berg J. M., Tymoczko J. L. &amp; Stryer, L. 2007. Biochemistry, 6th Ed. W. H. Freeman and Company, N.Y.</li> <li>Nelson D. &amp; Cox M. M. 2009. Principles of Biochemistry</li> </ul>
Reference Books	<ul style="list-style-type: none"> <li>Potter G. W. H &amp; Potter, Geoffrey W. 1995. Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic publishers.</li> <li>Wiley J., Sherwood L. And Woowerton C.2007.Prescott / Harley / Klein's Microbiology.</li> </ul>

<b>Assessment and Evaluation</b>		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks	Continuous Internal Assessment (CIA): 30 Marks	End Semester Exam (ESE): 70 Marks
Continuous Internal Assessment (CIA)	Internal Test/Quiz- (2): 20 & 20 Assignment / Seminar: 10 Total Marks: 30	Better marks out of the two Test / Quiz + obtained marks is Assignment shall be considered against <b>30</b> Marks
End Semester Exam (ESE)	<b>Three Section - A, B &amp; C</b> Section A: Q1. Objective- 10 x 1 = 10 Mark; Section B: Long Answer type questions 1 out of 2 from each unit- 4 x 5 = 20 Marks; Section C: Descriptive answer type questions 1 out of 2 from each unit- 4 x 10 = 40 Marks;	

Program Code and Name	<b>DPMS06, M.Sc. (MICROBIOLOGY)</b>			Semester	<b>II</b>
Exam Code and Name	<b>2062 - M. Sc. MICROBIOLOGY SECOND SEMESTER</b>			Paper	<b>II</b>
Course Code	<b>MMBT202</b>			Course Type	<b>T</b>
Course Title	<b>Microbial Physiology</b>				
Total Credit	<b>4/3/2/1</b>				
Total Marks	CIA: 30/15	ESE: 70/35	Max Marks: 100/50	Min. Pass. Marks: 40/20	
Prerequisites (if any)	NO				
Course Outcomes	CO1: Understand the basic cell functioning. CO2: Understand mechanism of cell Communication. CO3: Understand different metabolic pathways. CO4: Understand nutritional requirements of bacteria.				

<b>Contents of Course</b>		
<b>Unit</b>	<b>Contents</b>	<b>No. of Period</b>
I	<b>Nutritional types of bacteria:</b> Various physiological Groups Autotrophy, heterotrophy. Micro and Macro nutrients required for bacterial growth.	15
II	<b>Biological oxidation:</b> Components of electron transport chain, free energy changes and electron transport, oxidative phosphorylation and theories of ATP formation, inhibition of electron transport chain. Aerobic respiration: EMP pathway and Kerb's cycle.	15
III	<b>Bacterial anaerobic respiration:</b> Electron transport chains in some anaerobic bacteria. Catalase, super oxide dismutase, mechanism of oxygen toxicity. <b>Bacterial chemolithotrophs:</b> Ammonia oxidation by members of genus Oxidation of molecular hydrogen by Hydrogenomonas species. Ferrous and sulphur / sulfide oxidation by Thiobacillus species.	15
IV	<b>Bacterial photosynthesis:</b> Photosynthetic microorganisms, photosynthetic pigments, and generation of reducing power by cyclic and non-cyclic photophosphorylation, electron transport chain in photosynthetic bacteria. Carbon dioxide fixation pathways.	15
Total no. of Lectures		60

Text books	<ul style="list-style-type: none"> <li>Molecular Biology of the Cell - Albert, Johnson, Lewis, Raff, Roberts and Walter.</li> <li>Molecular Cell Biology. Lodish, Birk, and Zipursky. Freeman. Microbial Physiology by Albert G. Moat and John W. Foster. Third edition, John Wiley and Sons.</li> </ul>
Reference Books	<ul style="list-style-type: none"> <li>Nelson D. &amp; Cox M. M. 2009. Principles of Biochemistry</li> <li>Wiley J., Sherwood L. and Woolverton C. Prescott/Harley/Klein's Microbiology, McGraw Hill (Latest Ed.).</li> </ul>

<b>Assessment and Evaluation</b>		
<b>Suggested Continuous Evaluation Methods:</b>		
Maximum Marks: 100 Marks	Continuous Internal Assessment (CIA): 30 Marks	End Semester Exam (ESE): 70 Marks
Continuous Internal Assessment (CIA)	Internal Test/Quiz- (2): 20 & 20 Assignment / Seminar: 10 Total Marks: 30	Better marks out of the two Test / Quiz + obtained marks is Assignment shall be considered against <b>30</b> Marks
End Semester Exam (ESE)	<b>Three Section - A, B &amp; C</b> Section A: Q1. Objective- 10 x 1 = 10 Mark; Section B: Long Answer type questions 1 out of 2 from each unit- 4 x 5 = 20 Marks; Section C: Descriptive answer type questions 1 out of 2 from each unit- 4 x 10 = 40 Marks;	

Program Code and Name	<b>DPMS06, M.Sc. (MICROBIOLOGY)</b>			Semester	<b>II</b>
Exam Code and Name	<b>2062 - M. Sc. MICROBIOLOGY SECOND SEMESTER</b>			Paper	<b>III</b>
Course Code	<b>MMBT203</b>			Course Type	<b>T</b>
Course Title	<b>Microbial Genetics and Molecular Biology</b>				
Total Credit	<b>4/3/2/1</b>				
Total Marks	CIA: 30/15	ESE: 70/35	Max Marks: 100/50	Min. Pass. Marks: 40/20	
Prerequisites (if any)	NO				
Course Outcomes	CO1: Understand the basic role of genes. CO2: The types, nature and function of DNA. CO3: Study types of molecular and mechanism of their interaction. CO4: Understand genetic regulation.				

Unit	Contents	No. of Period
I	<b>Basic concepts of Microbial Genetics:</b> Nucleic acid as genetic material with experimental evidence. Bacterial transformation (types and mechanism). Transduction (types and mechanism), Sexduction, Conjugation F+/ F-/ Hir's / F-Prime, Plasmids and Transposons, role of plasmids in biotechnology, <b>Nucleic Acids: DNA:</b> Structure; historical aspects & current concepts; types of DNA, melting of DNA; DNA replication and enzymes involved in prokaryotes and eukaryotes. Super helicity in DNA, linking number, topological properties, mechanism of action of topoisomerases. RNA: Types and structure of RNA, RNA polymerase, Ribozyme and splicing of RNA. Inhibition of RNA Synthesis.	15
II	<b>Transcription:</b> Prokaryotic and Eukaryotic Enzyme involved in transcription, RNA Polymerases- Structure and Functions, Transcription Process- Initiation, Elongation, Termination, Rho dependent and Rho independent, Eukaryotic Transcriptional Factors, Promoters, Operators and Regulators, Post transcriptional Modification-RNA Editing.	15
III	<b>Genetic code and Gene expression Translation:</b> Genetic code – deciphering, properties and code dictionary. Central dogma of molecular biology. Protein synthesis in prokaryotes and eukaryotes; steps-detail of transcription and translation – initiation, elongation & termination, role of various factors in these steps, inhibitors of protein synthesis. Synthesis of exported protein on membrane bound ribosome; signal hypothesis. Post translational modification of proteins.	15
IV	<b>Regulation of Gene expression:</b> Concept of gene; one gene one enzyme hypothesis and its modification. Operon concept, negative and positive regulation, instability of bacterial mRNA, inducer and co-repressor, catabolic repression. Negative regulation – E. coli lac operon: positive regulation E. coli. Ara-operon; regulation by attenuation.	15
	Total no. of Lectures	60

Text books	<ul style="list-style-type: none"> <li>Benjamin Lewin. (2008) Genes IX, Jones and Bartlett Publishers Inc.</li> <li>Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson (2004), Molecular Biology of the Cell, 4 Edition, Garland Publishing</li> </ul>
Reference Books	<ul style="list-style-type: none"> <li>Watson James D., Tania Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick (2004)</li> <li>Molecular Biology of the Gene, 5<sup>th</sup> Edition, Pearson Education, Inc. and Dorling Kindersley Publishing.</li> </ul>

Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks	Continuous Internal Assessment (CIA): 30 Marks	End Semester Exam (ESE): 70 Marks
Continuous Internal Assessment (CIA)	Internal Test/Quiz- (2): 20 & 20 Assignment / Seminar: 10 Total Marks: 30	Better marks out of the two Test / Quiz + obtained marks is Assignment shall be considered against <b>30</b> Marks
End Semester Exam (ESE)	<b>Three Section - A, B &amp; C</b> Section A: Q1. Objective- 10 x 1 = 10 Mark; Section B: Long Answer type questions 1 out of 2 from each unit- 4 x 5 = 20 Marks; Section C: Descriptive answer type questions 1 out of 2 from each unit- 4 x 10 = 40 Marks;	

Program Code and Name	<b>DPMS06, M.Sc. (MICROBIOLOGY)</b>			Semester	<b>II</b>
Exam Code and Name	<b>2062 - M. Sc. MICROBIOLOGY SECOND SEMESTER</b>			Paper	<b>IV</b>
Course Code	<b>MMBT204</b>			Course Type	<b>T</b>
Course Title	<b>Agriculture Microbiology</b>				
Total Credit	<b>4/3/2/1</b>				
Total Marks	CIA: 30/15	ESE: 70/35	Max Marks: 100/50	Min. Pass. Marks: 40/20	
Prerequisites (if any)	NO				
Course Outcomes	CO1: Understand the association of microbes and agriculture crops. CO2: Understand the importance of microbial ecology. CO3: The advanced ways of Agriculture techniques. CO4: To learn basics techniques of PTC.				

Contents of Course		
Unit	Contents	No. of Period
I	<b>Introduction to Agriculture microbiology:</b> Soil microorganisms in agro system: Types of microbial communities Interrelationship between plant and microbes: Above and below ground parts and effect of agricultural practices on soil.	15
II	<b>Microbial ecology:</b> Chemical transformation and Nutrient mineralization by microbes in soil. Biological Nitrogen Fixation: Mechanism of nitrogen fixation, Biochemistry of nitrogenase. Genetics of nitrogen-fixation. Rhizobium- Legume Association, formation of root nodule. Importance of Leghaemoglobin.	15
III	<b>Disease Management:</b> Major plant diseases (Bacterial, Fungal and Viral) and their Biocontrol (bioherbicides, biopesticides, biofungicides and Bioinsecticides). Integrated Pest Management.	15
IV	<b>Biofertilizer:</b> Bacterial biofertilizer (Nitrogen fixers, PSB), Cyanobacterial biofertilizer and Fungal biofertilizer. Industrial production of Biofertilizer. Green manuring algalization. <b>Plant Tissue Culture:</b> History and Scope, Techniques and Applications. Biotechnology in agriculture- The new green revolution, Transgenic plants. Reclamation of barren lands using microbial technology.	15
Total no. of Lectures		60

Text books	<ul style="list-style-type: none"> <li>Eldor A. Paul. Soil Microbiology. Ecology and Biochemistry. VI Edition: Academic Press, (2007).</li> <li>Eugene L. Madsen. Environmental Microbiology: From Genomes to Biogeochemistry. I Edition, Wiley-Blackwell Publishing. (2008).</li> <li>Mehrotra R S and Ashok Agrawal. Plant Pathology. Tata Mc Graw Hill, 6th reprint (2006)</li> </ul>
Reference Books	<ul style="list-style-type: none"> <li>Agrios, G. N. Plant pathology. Harcourt Asia Pvt. Ltd. (2000).</li> <li>Buchanan. B.B., Grissem, W. and Jones, R.L Biochemistry and Molecular Biology of Plants. I.K. International Pvt. Ltd. (2000).</li> </ul>

Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks	Continuous Internal Assessment (CIA): 30 Marks	End Semester Exam (ESE): 70 Marks
Continuous Internal Assessment (CIA)	Internal Test/Quiz- (2): 20 & 20 Assignment / Seminar: 10 Total Marks: 30	Better marks out of the two Test / Quiz + obtained marks is Assignment shall be considered against <b>30</b> Marks
End Semester Exam (ESE)	<b>Three Section - A, B &amp; C</b> Section A: Q1. Objective- 10 x 1 = 10 Mark; Section B: Long Answer type questions 1 out of 2 from each unit- 4 x 5 = 20 Marks; Section C: Descriptive answer type questions 1 out of 2 from each unit- 4 x 10 = 40 Marks;	

Program Code and Name	<b>DPMS06, M.Sc. (MICROBIOLOGY)</b>			Semester	<b>II</b>
Exam Code and Name	<b>2062-M.Sc. MICROBIOLOGY SECOND SEMESTER</b>			Paper	<b>I</b>
Course Code	<b>MMBP201</b>			Course Type	<b>P</b>
Course Title	<b>LAB I- Bioinstrumentation, Biochemical Techniques and Microbial Physiology</b>				
Total Credit	<b>4/3/2/1</b>				
Total Marks	CIA: 30/15	ESE: 70/35	Max Marks: 100/50	Min. Pass. Marks: 40/20	
Prerequisites (if any)	<b>NO</b>				
Course Outcomes	CO1: Understand important instruments and their Suitable employability. CO2: Understand principle, construction and working of important instrument. CO3: Understand application of important instruments.				

<b>Contents of Course</b>	
<b>List of Experiments</b>	<b>No.of Period</b>
1. Calibration of pH meter and adjustment of buffer. 2. To verify Lambert Beer's law. 3. Studies of pH titration curve of amino acid/acetic acid and determination of pKa values and Handerson-Hasselbach equation. 4. Homogenisation of cells by centrifugation. 5. Testing efficiency of laminar flow hood. 6. Separation of bacterial lipid/amino acids/sugar/organic acid by TLC or paper chromatography. 7. Separations of serum proteins by horizontal submerged gel electrophoresis. 8. Paper electrophoresis and separation of haemoglobin or blue dextran by gel filtration. 9. Isolation and cultivation of autotrophic bacteria. 10. To study effect of salt concentration on bacterial growth by turbidometry method. 11. Determination of thermal death point (TDP) of an organism. 12. Effect of pH, salt concentration, metal, dyes, on growth of microorganism.	60Periods/ 40Hours
Total no. of Lectures	
60	

<b>Assessment and Evaluation</b>		
Suggested Continuous Evaluation Methods:		
Maximum Marks: 100 Marks	Continuous Internal Assessment (CIA): 30/15 Marks	End Semester Exam (ESE) : 70/35 Marks
Continuous Internal Assessment (CIA)	Internal Test/Quiz- (2): 20 & 20 / 10 & 10 Assignment / Seminar + Attendance: 10 / 5 Total Marks: 30 / 15	Better marks out of the two Test / Quiz + obtained marks is Assignment shall be considered against <b>30 / 15</b> Marks
End Semester Exam (ESE)	<b>Laboratory / Field Skill Performance:</b> On spot Assessment A: Performed the Task based on lab - 20 Marks /40 Marks B: Spotting based on tools & technology (written) - 10 Marks / 20 Marks Viva-voce (based on principle/technology) - 5 Marks / 10 Marks	Managed by Course teacher as per lab. status

Program Code and Name	<b>DPMS06, M.Sc. (MICROBIOLOGY)</b>			Semester	<b>II</b>
Exam Code and Name	<b>2062-M.Sc. MICROBIOLOGY SECOND SEMESTER</b>			Paper	<b>II</b>
Course Code	<b>MMBP202</b>			Course Type	<b>P</b>
Course Title	<b>LAB II - Medical and veterinary microbiology</b>				
Total Credit	<b>4/3/2/1</b>				
Total Marks	CIA: 30/15	ESE: 70/35	Max Marks: 100/50	Min. Pass. Marks: 40/20	
Prerequisites (if any)	<b>NO</b>				
Course Outcomes	CO1: Understand techniques to isolate beneficial soil Microbes. CO2: Understand the importance of microbes in Agriculture. CO3: Conceptualize PGPR and its applications.				

<b>Contents of Course</b>		
<b>List of Experiments</b>		<b>No. of Period</b>
<ol style="list-style-type: none"> <li>1. Isolation and characterization of Bacterial and Fungal micro flora of soil.</li> <li>2. Bioconversion of ammonia to nitrate (ammonification).</li> <li>3. Production of Ammonia from organic compound.</li> <li>4. Bioconversion of Ammonia to Nitrate (nitrification).</li> <li>5. Determination of Ammonia to Nitrate reduction.</li> <li>6. Characterization of different soils for the detection of various enzymes- amylase, lipase, protease and catalase.</li> <li>7. Microbiological characterization of Cyanobacteria.</li> <li>8. Separation and detection of Cyanobacterial pigment.</li> <li>9. Isolation of Rhizobium from Root Nodule.</li> <li>10. Isolation and enumeration of Bacterial and Fungal micro flora from rhizosphere, rhizoplane and phyllaosphere.</li> <li>11. Demonstration of bacterial antagonism, antibiotic producing organism, identification of symbiotic bacteroids of rhizobium.</li> <li>12. Isolation of Azotobacter/ Azospirillum from soil.</li> <li>13. Plant Tissue Culture- preparation of MS medium and Gamborg's BS medium, sterilization of explants, initiation of PTC by shoot bud or callus culture.</li> </ol>		60Periods/ 40Hours
Total no. of Lectures		60

<b>Assessment and Evaluation</b>		
<b>Suggested Continuous Evaluation Methods:</b>		
Maximum Marks: 100 Marks	Continuous Internal Assessment (CIA): 30/15 Marks	End Semester Exam (ESE) : 70/35 Marks
Continuous Internal Assessment (CIA)	Internal Test/Quiz- (2): 20 & 20 / 10 & 10 Assignment / Seminar + Attendance: 10 / 5 Total Marks: 30 / 15	Better marks out of the two Test / Quiz + obtained marks is Assignment shall be considered against <b>30 / 15</b> Marks
End Semester Exam (ESE)	<b>Laboratory / Field Skill Performance:</b> On spot Assessment A: Performed the Task based on lab - 20 Marks /40 Marks B: Spotting based on tools & technology (written) - 10 Marks / 20 Marks Viva-voce (based on principle/technology) - 5 Marks / 10 Marks	Managed by Course teacher as per lab. status