AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0263	Report Date : 17/03/2025
Issued To: M/s. R.L. Jalappa Hospital Tamaka, Kolar.	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: AHS Mens Hostel Backside Drinking Water	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.83	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	177	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	110.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	15.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	10.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	5.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	52.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	7.9	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	24.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	19.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0262	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: APJ Abdul Kalam Mens Hostel Terrace	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.80	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	120	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	75.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	8.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	5.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	3.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	19.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	<1.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	15.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	6.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 . 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

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TEST REPORT

Report No: AESTL/25/03/W/0261	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: APJ Abdul Kalam Mens Hostel Mess	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L) (As per IS 10500:2012)	Maximum Permissible Limits (in mg/L) (As per IS 10500:2012)	Protocol IS-3025
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.71	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	111	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	69.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	20.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	13.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	7.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	24.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	<1.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	14.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	10.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

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Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0253	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal Date of Receipt : 10/03/2025 Date of test Start : 10/03/2025 Date of Completion of test: 15/03/2025
Sample Location: R.L. Jalappa Central School	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L) (As per IS 10500:2012)	Maximum Permissible Limits (in mg/L) (As per IS 10500:2012)	Protocol IS-3025
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.69	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	60	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	37.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	12.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	7.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	5.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	13.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	<1.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	9.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	4.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By

AES TESTING LABORATORY BANGALORE

Authorised Signature

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TEST REPORT

Report No: AESTL/25/03/W/0254	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: PG Mens Hostel Mess	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.53	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	50	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	31.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	8.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	5.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	3.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	8.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	<1.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	10.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	3.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

AES TESTING LABORATORY BANGALORE

Tested By :

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

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TEST REPORT

Report No: AESTL/25/03/W/0255	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: Ladies UG Hostel (Jhansi Rani Lakshmi Bai)	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L) (As per IS 10500:2012)	Maximum Permissible Limits (in mg/L) (As per IS 10500:2012)	Protocol IS-3025
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.85	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	182	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	113.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	28.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	19.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	9.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	44.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	2.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	15.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	19.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

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Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0256	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: Ladies PG Hostel (Kittur Rani Chennamma)	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L) (As per IS 10500:2012)	Maximum Permissible Limits (in mg/L) (As per IS 10500:2012)	Protocol IS-3025
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.64	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	120	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	75.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	6.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	4.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	2.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	30.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	<1.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	12.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	10.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

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TEST REPORT

Report No: AESTL/25/03/W/0257	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: Ladies Mess (Savithri Bai Phule)	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	7.03	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	477	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	298.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	76.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	51.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	25.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	130.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	5.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	48.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	7.4	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	1.5	----	----	IS:3025/Part-35
Sodium as Na,mg/L	36.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

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TEST REPORT

Report No: AESTL/25/03/W/0258	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: AHS Ladies Hostel (Sarojini Naidu)	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.75	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	426	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	266.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	84.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	59.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	25.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	110.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	4.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	44.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	9.4	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	2.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	31.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0259	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: AHS Mens Hostel Mess	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L) (As per IS 10500:2012)	Maximum Permissible Limits (in mg/L) (As per IS 10500:2012)	Protocol IS-3025
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.64	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	225	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	140.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	28.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	18.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	10.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	49.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	1.6	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	35.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	17.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0260	Report Date : 17/03/2025
Issued To: M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar..	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: College Building Biochemistry Lab	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.68	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	185	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	115.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	40.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	27.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	13.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	41.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	1.3	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	21.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	15.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By:

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0264	Report Date : 17/03/2025
Issued To: M/s. R.L. Jalappa Hospital Tamaka, Kolar.	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: Ward Block Plant	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.95	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	185	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	115.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	47.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	30.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	17.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	35.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	1.9	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	28.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	5.4	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	30.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0265	Report Date : 17/03/2025
Issued To: M/s. R.L. Jalappa Hospital Tamaka, Kolar.	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: Hospital Kitchen	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.70	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	93	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	58.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	9.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	5.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	4.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	20.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	<1.0	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	15.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	8.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

TEST REPORT

Report No: AESTL/25/03/W/0266	Report Date : 17/03/2025
Issued To: M/s. R.L. Jalappa Hospital Tamaka, Kolar.	Customer Reference: Verbal
	Date of Receipt : 10/03/2025
	Date of test Start : 10/03/2025
	Date of Completion of test: 15/03/2025
Sample Location: Nursing Hostel Mess	Sample Particulars : RO Plant Water

Tests	Results	Maximum Acceptable Limits (in mg/L)	Maximum Permissible Limits (in mg/L)	Protocol IS-3025
		(As per IS 10500:2012)		
Odour	Agreeable	Agreeable	Agreeable	APHA 2150 C
Turbidity, NTU	<1.0	1	5	APHA 2130 B
Total Suspended Solids, mg/L	<1.0	----	----	APHA 2540 D
pH Value	6.84	6.5 – 8.5	No Relaxation	APHA 4500 H^+ B
Electrical Conductivity, µs/cm	239	----	----	APHA 2510 B
Total Dissolved Solids, mg/L	149.0	500	2000	APHA 2540 C
Total Hardness as $CaCO_3$, mg/L	32.0	200	600	APHA 2340 C
Calcium Hardness, mg/L	20.0	----	----	APHA 3500 Ca
Magnesium Hardness, mg/L	12.0	----	----	APHA 3500 Mg - B
Chloride as Cl, mg/L	56.0	250	1000	APHA 4500 Cl
Sulphate as SO_4, mg/L	2.6	200	400	APHA 4500 SO_4 - E
Nitrate as NO_3, mg/L	<0.5	45	No Relaxation	IS 3025 Part 34
Nitrite as NO_2, mg/L	Absent	----	----	IS 3025 Part 34
Fluoride as F, mg/L	<0.1	1.0	1.5	APHA 4500 F- D
Iron as Fe, mg/L	<0.1	0.3	No Relaxation	APHA 3500 Fe
Total Alkalinity as $CaCO_3$, mg/L	30.0	200	600	APHA 2320 B
Phenolphthalein Alkalinity, mg/L	Nil	----	----	IS:3025/Part-23
Reactive Silica as SiO_2,mg/L	<1.0	----	----	IS:3025/Part-35
Colloidal Silica as $CSiO_2$,mg/L	<1.0	----	----	IS:3025/Part-35
Sodium as Na,mg/L	26.0	----	----	IS:3025/Part-45
Total Coliform Count/100ml	Absent	Absent		IS 15185-RA 2018
E. Coli /100ml	Absent	Absent		IS 15185-RA 2018

Remarks: The given water sample meets to maximum acceptable limits as per IS 10500 : 2012 for above physical , chemical and microbiological testing.

**********End of the Report*********

AES TESTING LABORATORY BANGALORE

Tested By :

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. R.L. Jalappa Hospital Tamaka, Kolar.
Name of the Location	In front of RL Jalappa Hospital Main Gate
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/030

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	72.5	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	18.7	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	35.6	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

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Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	In front of College Main Gate
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/031

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	64.7	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	18.7	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	28.5	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	In front of Medical College Building
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/032

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	57.5	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	16.0	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	24.0	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	In front of ladies Hostel
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/033

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	38.1	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	8.0	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	20.8	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

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AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	Near Coconut Garden
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/034

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	70.0	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	13.3	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	20.2	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality , BDL- Below Detectable Limit

Report Status: The Results are within the Standards.

****End of Report****

Tested By:

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	In front of Boys Hostel
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/035

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	55.4	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	21.3	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	33.0	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

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AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. R.L. Jalappa Hospital Tamaka, Kolar.
Name of the Location	In front of Nursing College
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/036

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	47.2	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	10.6	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	22.1	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By

AES TESTING LABORATORY BANGALORE

Authorised Signature

Note : 1. The Result listed pertain only to tested samples and applicable parameters. 2. Samples will be destroyed after 15 days from the date of issue of test certificate unless & otherwise Specified. 3. This Report is not be reproduced either wholly or in part and can not be used an evidence in the count of law and should not any adverting media without prior Written permission. 4. Sampling not done by us, unless specified.

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44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	In front of Academy Building
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/037

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	63.0	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	10.7	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	25.6	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By :

AES TESTING LABORATORY BANGALORE

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AES TESTING LABORATORY

(ISO 9001:2005/ISO45001:2018 Certified Laboratory/NABL Accredited Laboratory)

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AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	In front of RL Jalappa Central School
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/038

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	43.5	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	16.0	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	25.9	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By

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44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

AMBIENT AIR QUALITY REPORT

Name of the Company & Address	M/s. Sri DevarajUrs Academy of Higher Education & Research Tamaka, Kolar.
Name of the Location	Near Doctors Club housing Layout
Date of Sampling:	10/03/2025
Date of Analysis	11/03/2025
Sampled By	Lab Representative
Report Date:	15/03/2025
Report No:	AESTL/25/03/ED/039

Results:

Sl no.	Parameters	Units	Results	NAAQ Standard	Test Method
1	Respirable Suspended Particulate Matter (PM_{10})	$\mu g/m^3$	52.9	100 Max	IS:5182 (Part 23) 2017
2	Sulphur Dioxide (SO_2)	$\mu g/m^3$	10.6	80 Max	IS:5182 (Part 2) 2017
3	Oxides of Nitrogen (NO_2)	$\mu g/m^3$	24.9	80 Max	IS:5182 (Part 6) 2017

NAAQ- National Ambient air Quality

Report Status: The Results are within the Standards.

****End of Report****

Tested By

AES TESTING BANGALORE

Authorised Signature

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44, 45, 1st Main Road, Vinayaka Nagar, Bagalagunte, Nagasandra Post, Bangalore - 560 073.

Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

ANALYSIS OF REPORT OF SOURCE EMISSION

NAME OF THE COMPANY	M/s. Sri DevarajUrs Academy of Higher Education & Research
ADDRESS	Tamaka, Kolar
Sample Particulars	750 KVA DG Set
Date of Sampling	10/03/2025
Sampled By	Lab Representative
Sample ID	AESTL/25/03/ED/040
Date of Analysis	11/03/2025
Date of Report	15/03/2025

Stack Diameter	0.26 mts
Stack Cross Sectional Area	0.05 m^2
Temperature of flue Gas	183 °C
Ambient Temperature	32 °C
Velocity of Flue Gas	10.97mts/sec
Discharge Rate	1974.6 Nm^3/hr
Emission Rate	0.139 Kg/hr

Sl No	Parameters	Protocol	Units	Results	KSPCB Standards
01	Particular Matter	IS 11255(part 1)	mg/Nm^3	70.3	150 Max
02	Sulphur Dioxide (So_2)	IS 11255(part 2)	mg/Nm^3	17.5	100 Max
03	Oxide of Nitrogen (NO_X)	IS 11255(part 7)	mg/Nm^3	35.0	50 Max

Report Status: The Results are within the Standards.

**********End of the Report**********

Tested By :

AES TESTING LABORATORY BANGALORE KARNATAKA

Authorised Signature

Note : 1. The Result listed pertain only to tested samples and applicable parameters. 2. Samples will be destroyed after 15 days from the date of issue of test certificate unless & otherwise Specified. 3. This Report is not be reproduced either wholly or in part and can not be used an evidence in the count of law and should not any adverting media without prior Written permission. 4. Sampling not done by us, unless specified.

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ANALYSIS OF REPORT OF SOURCE EMISSION

NAME OF THE COMPANY	M/s. Sri DevarajUrs Academy of Higher Education & Research
ADDRESS	Tamaka, Kolar
Sample Particulars	630 KVA DG Set
Date of Sampling	10/03/2025
Sampled By	Lab Representative
Sample ID	AESTL/25/03/ED/041
Date of Analysis	11/03/2025
Date of Report	15/03/2025

Stack Diameter	0.26 mts
Stack Cross Sectional Area	0.05 m^2
Temperature of flue Gas	164 °C
Ambient Temperature	31 °C
Velocity of Flue Gas	9.7 mts/sec
Discharge Rate	1746.0 Nm^3/hr
Emission Rate	0.094 Kg/hr

Sl No	Parameters	Protocol	Units	Results	KSPCB Standards
01	Particular Matter	IS 11255(part 1)	mg/Nm^3	54.2	150 Max
02	Sulphur Dioxide (So_2)	IS 11255(part 2)	mg/Nm^3	15.3	100 Max
03	Oxide of Nitrogen (NO_X)	IS 11255(part 7)	mg/Nm^3	40.8	50 Max

Report Status: The Results are within the Standards.

**********End of the Report**********

Tested By

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ANALYSIS OF REPORT OF SOURCE EMISSION

NAME OF THE COMPANY	M/s. Sri DevarajUrs Academy of Higher Education & Research
ADDRESS	Tamaka, Kolar
Sample Particulars	500 KVA DG Set -2
Date of Sampling	10/03/2025
Sampled By	Lab Representative
Sample ID	AESTL/25/03/ED/042
Date of Analysis	11/03/2025
Date of Report	15/03/2025

Stack Diameter	0.24 mts
Stack Cross Sectional Area	0.045 m^2
Temperature of flue Gas	169 °C
Ambient Temperature	32 °C
Velocity of Flue Gas	9.96 mts/sec
Discharge Rate	1613.5 Nm^3/hr
Emission Rate	0.097 Kg/hr

Sl No	Parameters	Protocol	Units	Results	KSPCB Standards
01	Particular Matter	IS 11255(part 1)	mg/Nm^3	60.8	150 Max
02	Sulphur Dioxide (So_2)	IS 11255(part 2)	mg/Nm^3	16.0	100 Max
03	Oxide of Nitrogen (NO_X)	IS 11255(part 7)	mg/Nm^3	29.8	50 Max

Report Status: The Results are within the Standards.

**********End of the Report**********

Tested By:

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ANALYSIS OF REPORT OF SOURCE EMISSION

NAME OF THE COMPANY	M/s. Sri DevarajUrs Academy of Higher Education & Research
ADDRESS	Tamaka, Kolar
Sample Particulars	500 KVA DG Set -4
Date of Sampling	10/03/2025
Sampled By	Lab Representative
Sample ID	AESTL/25/03/ED/043
Date of Analysis	11/03/2025
Date of Report	15/03/2025

Stack Diameter	0.24 mts
Stack Cross Sectional Area	0.045 m^2
Temperature of flue Gas	180 °C
Ambient Temperature	32 °C
Velocity of Flue Gas	10.1 mts/sec
Discharge Rate	1636.2 Nm^3/hr
Emission Rate	0.093 Kg/hr

Sl No	Parameters	Protocol	Units	Results	KSPCB Standards
01	Particular Matter	IS 11255(part 1)	mg/Nm^3	56.8	150 Max
02	Sulphur Dioxide (So_2)	IS 11255(part 2)	mg/Nm^3	26.7	100 Max
03	Oxide of Nitrogen (NO_x)	IS 11255(part 7)	mg/Nm^3	36.4	50 Max

Report Status: The Results are within the Standards.

**********End of the Report**********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

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Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

ANALYSIS OF REPORT OF SOURCE EMISSION

NAME OF THE COMPANY	M/s. Sri DevarajUrs Academy of Higher Education & Research
ADDRESS	Tamaka, Kolar
Sample Particulars	500 KVA DG Set -3 (Guest House)
Date of Sampling	10/03/2025
Sampled By	Lab Representative
Sample ID	AESTL/25/03/ED/044
Date of Analysis	11/03/2025
Date of Report	15/03/2025

Stack Diameter	0.24 mts
Stack Cross Sectional Area	0.045 m^2
Temperature of flue Gas	179 °C
Ambient Temperature	31 °C
Velocity of Flue Gas	10.4 mts/sec
Discharge Rate	1684.8 Nm^3/hr
Emission Rate	0.082 Kg/hr

Sl No	Parameters	Protocol	Units	Results	KSPCB Standards
01	Particular Matter	IS 11255(part 1)	mg/Nm^3	48.7	150 Max
02	Sulphur Dioxide (So_2)	IS 11255(part 2)	mg/Nm^3	21.1	100 Max
03	Oxide of Nitrogen (NO_X)	IS 11255(part 7)	mg/Nm^3	34.4	50 Max

Report Status: The Results are within the Standards.

**********End of the Report**********

Tested By :

AES TESTING BANGALORE LABORATORY

Authorised Signature

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Mob : 9538555792, 9538555283, 9000565208, Email : aestestinglaboratory@gmail.com Web : www.aeslabs.co.in

ANALYSIS OF REPORT OF SOURCE EMISSION

NAME OF THE COMPANY	M/s. R.L. Jalappa Hospital (OPD)
ADDRESS	Tamaka, Kolar
Sample Particulars	82.5 KVA DG Set
Date of Sampling	10/03/2025
Sampled By	Lab Representative
Sample ID	AESTL/25/03/ED/045
Date of Analysis	11/03/2025
Date of Report	15/03/2025

Stack Diameter	0.08 mts
Stack Cross Sectional Area	0.005 m^2
Temperature of flue Gas	91 °C
Ambient Temperature	29 °C
Velocity of Flue Gas	8.0 mts/sec
Discharge Rate	144.0 Nm^3/hr
Emission Rate	0.004 Kg/hr

Sl No	Parameters	Protocol	Units	Results	KSPCB Standards
01	Particular Matter	IS 11255(part 1)	mg/Nm^3	32.6	150 Max
02	Sulphur Dioxide (So_2)	IS 11255(part 2)	mg/Nm^3	10.0	100 Max
03	Oxide of Nitrogen (NO_X)	IS 11255(part 7)	mg/Nm^3	21.1	50 Max

Report Status: The Results are within the Standards.

**********End of the Report**********

Tested By :

AES TESTING LABORATORY BANGALORE

Authorised Signature

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

(A Deemed to be University declared under Section 3 of UGC Act 1956)

Comprising Sri Devaraj Urs Medical College

[Constituent unit of Sri Devaraj Urs Educational Trust for Backward Classes (Regd.)]

TAMAKA, KOLAR-563 103, KARNATAKA, INDIA

Ph: 918152-243003, +91 9448395232, E-mail – registrar@sduaher.ac.in / office@sduaher.ac.in. Website: www.sduaher.ac.in

No.SDUAHER/KLR/ADMN/479 /2025-26 Date: 6h May 2025

CIRCULAR

Sub: Guidelines for Paper usage and Printer settings.

In an effort to promote sustainability and reduce unnecessary paper consumption, The Academy is implementing the following measures with immediate effect.

1. **Use of one-sided papers:**
   All the staff members are encouraged to reuse one-sided printed papers for drafts, internal notes and other informal purposes wherever appropriate.
2. **Printer settings adjustment:**
   Printers will be reconfigured to default to **double-sided (duplex) printing**. Please ensure that you check your print settings and use double-sided printing to minimize paper usage.
3. **Minimizing paper usage:**
   Before printing, kindly consider if a digital version would suffice. Where possible, use e-mails, PDFs and other electronic methods for communication and documentation.

Your cooperation is vital in helping The Academy build an environmentally responsible workplace. Together, we can make a significant impact by taking small yet meaningful steps.

Thank you for your support.

Registrar

Registrar
Sri Devaraj Urs Academy of Higher Education and Research
Tamaka, Kolar - 563 103.

Chief Administrative Officer

Chief Administrative Officer
Sri Devaraj Urs Academy of Higher Education and Research
Tamaka, Kolar-563103

Copy to:

1. P.A to Vice Chancellor, SDUAHER
2. The Dean, Faculty of Medicine, SDUAHER & Principal, SDUMC.
3. The Dean, Faculty of AH & BS, SDUAHER
4. The Medical Superintendent, RLJH & RC.
5. All the Officers / Section Heads of The Academy, SDUAHER.
6. All the HoDs, SDUMC.
7. All the HoDs, Faculty of AH&BS, SDUAHER.
8. The Principal, Sri Devaraj Urs College of Nursing.
9. The Principal, R.L.Jalappa College of Pharmacy.
10. O/c.

Statement of solar energy generation from Solar roof top Ssytem installed in SDUAHER Campus

Sl.No	Month	Units	Amount
A	**HT35 Installation -750KW**		
1	Dec-24	34683	300007.00
2	Jan-25	44800	387520.00
03	Feb-25	82956	717569.00
04	Mar-25	67060	580069.00
05	Apr-25	91963	795479.00
06	May-25	71947	622341.00
	A Total	393409	3402985.00
B	**HT60 Installation -750KW**		
1	Dec-24	37358	323146.00
2	Jan-25	48255	417406.00
03	Feb-25	79709	689482.00
04	Mar-25	48255	417405.00
05	Apr-25	46844	405200.00
06	May-25	63888	552631.00
	B Total	324309	2805270.00
C	**HT61 Installation -250KW**		
1	Oct-24	16100	139265.00
2	Nov-24	23475	203059.00
3	Dec-24	23241	201034.00
4	Jan-25	31021	268331.00
5	Feb-25	16294	140943.00
6	Mar-25	20806	179971.00
7	Apr-25	32846	284117.00
8	May-25	29104	251749.00
	C Total	192887	1668469.00
	Total A + B + C	**910605**	**7876724.00**

ASSISTANT ENGINEER
ENGG. MAINTENANCE SECTION
SDUAHER, TAMAKA, KOLAR-563101

	SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH KOLAR - 563 103	Format No.	ENG03
		Issue No.	01
		Revision	00
		Date	01-11-2005

INFRASTRUCTURE PROJECT MAINTENANCE AND ALLIED SERVICES

Statement of solar energy generated from Solar roof top system from June 2024 to June 2025 installed in SDUAHER Campus

Sl.No	Month	Units	
A	**HT35 Installation -750KW**		
1	Dec-24	34683	300008.00
2	Jan-25	44800	387520.00
3	Feb-25	82956	717569.00
4	Mar-25	67060	580069.00
5	Apr-25	91963	795479.00
6	May-25	71947	622341.00
7	Jun-25	73094	628608.00
	A Total	**466503**	**4031594.00**
B	**HT60 Installation -750KW**		
1	Dec-24	37358	323146.00
2	Jan-25	48255	417406.00
3	Feb-25	79709	689482.00
4	Mar-25	48255	417405.00
5	Apr-25	46844	405200.00
6	May-25	63888	552631.00
7	Jun-25	61962	532873.00
	B Total	**386271**	**3338143.00**
C	**HT61 Installation -250KW**		
1	Oct-24	16100	139265.00
2	Nov-24	23475	203059.00
3	Dec-24	23241	201034.00
4	Jan-25	31021	268331.00
5	Feb-25	16294	140943.00
6	Mar-25	20806	179971.00
7	Apr-25	32846	284117.00
8	May-25	29104	251749.00
9	Jun-25	28733	247109.00
	C Total	**221620**	**1915578.00**
	Total A + B + C	**1074394**	**9285315.00**

Assistant Engineer
Electrical
ASSISTANT ENGINEER (ELE
ENGG. MAINTENANCE SECTION,
SDUAHER, TAMAKA, KOLAR-563103

General Manager
IPMAS
General Manager
Infrastructure, Projects
Maintenance & Allied Services
SDUAHER, Tamaka, Kolar-563103

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH
(A Deemed to be University Declared under Section 3 of UGC Act, 1956)
Comprising Sri Devaraj Urs Medical College
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Ph: 08152-243009, +91 9448395232 Fax: +918152 - 243008 E-mail: registrar@sduu.ac.in/office@sduu.ac.in. Website: www.sduu.ac.in

CHOICE BASED CREDIT SYSTEM

(CBCS)

(With effect from 2025-2026 batches)

Curriculum for 4-year BSc Honours

Food Science and Technology Programme

Approved as per AC-48-2024, (Resolution No-XLVIII-15) Dated-27.05.2024

4 Years B.Sc (Hons) Food Science and Technology

STRUCTURE OF THE PROGRAMME

SEMESTER I

Category	Course Code	Course	Total marks	Internal	Sem End exam	Teaching Hours	Credits
Ability Enhancement compulsory Courses	FSTL1.1	First Language Kannada	100	20	80	45	3
	FSTL1.2	Second Language English	100	20	80	45	3
Major DSCC (Discipline Specific Core Courses)	FST1.1	Introduction to Food Science and Technology (Th)	100	20	80	60	4
	FST1.2	Fundamentals of Food Science (Th)	100	20	80	60	4
Major DSCC Practical courses	FST1.3	Introduction to Food Science and Technology (Pra)	50	10	40	60	2
	FST1.4	Fundamentals of Food Science (Pra)	50	10	40	60	2
Minor (Open Elective)	OE1	Food safety, Quality and Certification (Th)/ Sensory Evaluation of Food	100	20	80	45	3
Skill Enhancement Courses	SEC1	Essential techniques in Life Sciences (Industrial Visits)	50	-	-	90	2
Total			650			405	23

SEMESTER II

Category	Course Code	Course	Total marks	Internal	Sem End exam	Teaching Hours/sem	Credits
Ability Enhancement compulsory Courses	FSTL2.1	First Language Kannada	100	20	80	45	3
	FSTL1.1	Professional English	100	20	80	45	3
Multi-Disciplinary	MD 1	Environmental studies	50	10	40	30	2
Major DSCC (Discipline Specific Core Courses)	FST 2.1	Food Chemistry (Th)	100	20	80	60	4
	FST 2.2	Technology of Food Processing & Preservation (Th)	100	20	80	60	4
Major DSCC Practical courses	FST 2.3	Food Chemistry (Pr)	50	10	40	60	2
	FST 2.4	Technology of Food Processing & Preservation(Pr)	50	10	40	60	2
Minor (Open Elective)	OE2	Food Sanitation and Hygiene/ Food Adulteration	100	20	80	30	2

Skill Enhancement Courses	SEC2	Food Informatics	100	20	80	30	2
Value Added course	VD 1	Human Values & Professional Ethics	50	10	40	30	2
Total			750			450	26

SEMESTER III

Category	**Course Code**	**Course**	**Total marks**	**Internal**	**Sem End exam**	**Teaching Hours**	**Credits**
Multi-Disciplinary	MD 2	Indian Constitution	50	10	40	30	2
Major DSCC (Discipline Specific Core Courses)	FST 3.1	Technology of Cereals, Pulses and oil seeds (Th)	100	20	80	60	4
	FST 3.2	Technology of Meat, Poultry and their Products (Th)	100	20	80	60	4
Major DSCC Practical courses	FST 3.3	Technology of Cereals, Pulses and oil seeds (Pr)	50	10	40	60	2
	FST 3.4	Technology of Meat, Poultry and their Products (Pr)	50	10	40	60	2
Minor (Open Elective)	OE 3	Technology of Plantation and Processing of Vegetables (Tomato) (Th)	100	20	80	45	3
		Technology of Plantation and Processing of Vegetables (Tomato) (Pra) or Bakery Technology (Th) Bakery Technology (Pra)	50	10	40	60 45 60	2 3 2
Skill Enhancement Courses	SEC 3	Mushroom Cultivation Technology	50	10	40	30	2
Total			550			420	21

SEMESTER IV

Category	**Course Code**	**Course**	**Total marks**	**Internal**	**Sem end exam**	**Teaching Hours**	**Credits**
Multi-Disciplinary	MD 3	Cyber Security	50	10	40	45	3
Major DSCC (Discipline Specific Core Courses)	FST 4.1	Food Analysis (Th)	100	20	80	60	4
	FST 4.2	Food Product Development (Th)	100	20	80	60	4
Major Practical Core courses	FST 4.3	Food Analysis (Pr)	50	10	40	60	2
	FST 4.4	Food Product Development (Pr)	50	10	40	60	2
Minor (Open Elective)	OE 4	Food Trade and Business Management / Organic Farming (Th)	100	20	80	45	3

Skill Enhancement Courses	SEC 4	Food Packaging and Labeling (Th)	100	20	80	45	3
Value based	VA 2	Basic Life Support (Th)	50	10	40	30	2
Total			550			405	23

SEMESTER V

Category	**Course Code**	**Course**	**Total marks**	**Internal**	**Sem end Exam**	**Teaching Hours**	**Credits**
Multi-Disciplinary	MD 3	AI Applications in Food Science and Technology (Th)	50	10	40	30	2
DSCC (Discipline Specific Core Courses)	FST 5.1	Food Microbiology (Th)	100	20	80	60	4
	FST 5.2	Technology of Marine based Foods (Th)	100	20	80	60	4
DSCC Practical	FST 5.3	Food Microbiology (Pr)	50	10	40	60	2
	FST 5.4	Technology of Marine based Foods (Pr)	50	10	40	60	2
Discipline Specific electives (DSE)	FST 5.4	Food Biotechnology (Th) / Functional Food and Nutraceuticals (Th)	100	20	80	45	3
DSE Practical	FST 5.5	Food Biotechnology (Pr)	50	10	40	30	1
Skill Enhancement Courses	SEC 5	Food Marketing	100	20	80	30	2
Value Added course	VA 3	Entrepreneurship & management of start ups	50	10	40	45	3
Total			550			420	23

SEMESTER VI

Category	**Course Code**	**Course**	**Total marks**	**Internals**	**Sem end exam**	**Teaching Hours**	**Credits**
DSCC (Discipline Specific Core Courses)	FST 6.1	Dairy Technology (Th)	100	20	80	60	4
	FST 6.2	Technology of Processing Fats and Oils (Th)	100	20	80	60	4
DSCC Practical	FST 6.3	Dairy Technology (Pr)	50	10	40	60	2
	FST 6.4	Technology of Processing Fats and Oils (Pr)	50	10	40	60	2
Discipline Specific electives (DSE)	FST 6.5	Beverage Technology (Th) / Technology Spices and Plantation of Crops (Th)	100	20	80	45	3
	FST 6.6	Beverage Technology (Pr)	50	10	40	60	2
Field Projects/ Internship		Food industry Internship	50	10	40	270	6
Total			500			615	23

(Exit Option with B.Sc. in Food Science and Technology (145 Credits)

All students will undertake a two-month summer industry internship.

- Students opting for an exit with a **B.Sc. Food Science and Technology** will do so after completing the industry internship.
- Students continuing with the **B.Sc. Honours Food Science and Technology** will proceed to Semester VII after the internship.

SEMESTER VII

Category	Course Code	Course	Total marks	Internals	Sem End exam	Teaching Hours	Credits
DSCC (Discipline Specific Core Courses)	FST 7.1	Unit operations in Food Industry (Th)	100	20	80	60	4
	FST 7.2	Enzymes in Food Processing (Th)	100	20	80	60	4
	FST 7.3	Research Methodology and Biostatistics (Th)	100	20	80	60	4
DSCC Practical	FST 7.4	Unit operations in Food Industry (Pr)	50	10	40	60	2
	FST 7.5	Enzymes in Food Processing (Pr)	50	10	40	60	2
DSE	FST 7.6	Food Industrial waste management (Th) / Food Additives (Th)	100	20	80	45	3
Field based Project	FBP 1	Field based Project	50	10	40	30	2
Total			550			435	21

SEMESTER VIII

Category	Course Code	Course	Total marks	Internals	Sem end exam	Teaching Hours	Credits
DSCC (Discipline Specific Core Courses)	FST 8.1	Food Toxicity and Safety Regulations (Th)/	100	20	80	60	4
		Fermentation Technology (Th)	100	20	80	60	4
		Food Extrusion Technology (Th)	100	20	80	60	4
DSCC Practical		Fermentation Technology (Pr)	50	10	40	60	2
		Food Extrusion Technology (Pr)	50	10	40	60	2
DSE		Flavour chemistry & Technology/ Food Plant Layout and Design	100	20	80	60	4
Project	FST 8.2	Dissertation based on project work	100	-	100	420	14
Total			300			540	20

Students opting for a B.Sc. (Hons) in Food Science and Technology must complete all required courses.

Students opting for a B.Sc. (Hons) in Food Science and Technology with Research must take Food Extrusion Technology (Th&Tr), complete a major research project, and earn a total of 178 credits.

Clinical Area/Unit	Duration (Weeks)	Learning Outcomes	Skills/Procedural Competencies	Clinical Requirements	Assessments Methods
		mental health problems • Assist in various therapies • Counsel and educate patients, families and significant others	assessment • Recording therapeutic communication • Administration of medications • Assist Electro-Convulsive Therapy (ECT) • Participating in all therapies • Preparing patients for Activities of Daily Living (ADL) • Conducting admission and discharge counselling • Counseling and teaching patients and families	• Care plan • Clinical presentation – 1 • Process recording – 2 • Maintain drug book	• Evaluation of the case study, care plan, clinical presentation, process recording • Completion of activity record
Community psychiatry & Deaddiction centre	1	• Identify patients with various mental disorders • Motivate patients for early treatment and follow up • Assist in follow up clinic • Counsel and educate patient, family and community • Observe the assessment and care of patients at deaddiction centre	• Conduct home visit and case work • Identifying individuals with mental health problems • Assisting in organizations of Mental Health camp • Conducting awareness meetings for mental health & mental illness • Counseling and Teaching family members, patients and community • Observing deaddiction care	• Case work – 1 • Observation report on field visits • Visit to deaddiction centre	• Assess performance with rating scale • Evaluation of case work and observation report • Completion of activity record

COMMUNITY HEALTH NURSING - I
including Environmental Science & Epidemiology

PLACEMENT: V SEMESTER

THEORY: 5 Credits (100 hours) includes Lab hours also

PRACTICUM: Clinical: 2 Credits (160 hours)

DESCRIPTION: This course is designed to help students develop broad perspectives of health, its determinants, about community health nursing and understanding about the health care delivery services, health care policies and regulations in India. It helps the students to develop knowledge and understanding of environmental science. It further helps them to apply the principles and concepts of BCC and health education for health promotion and maintenance of health within the community in wellness and illness continuum. It helps students to practice Community Health Nursing for the individuals, family and groups at rural, urban and tribal settings by applying principles of community health nursing and epidemiological approach. It also helps the students to develop knowledge and competencies required to screen, assess, diagnose, manage and refer clients appropriately in various health care settings. It prepares the students to provide primary healthcare to clients of all ages in the community, DH, PHC, CHC, SC/HWC and develop beginning skills in participating in all the National Health Programs.

COMPETENCIES: On completion of the course, the students will be able to

1. Explore the evolution of public health in India and community health nursing
2. Explain the concepts and determinants of health
3. Identify the levels of prevention and health problems of India
4. Develop basic understanding about the health care planning and the present health care delivery system in India at various levels
5. Locate the significance of primary health care and comprehensive primary health care as part of current health care delivery system focus
6. Discuss health care policies and regulations in India
7. Demonstrate understanding about an overview of environmental science, environmental health and sanitation
8. Demonstrate skill in nutritional assessment for different age groups in the community and provide appropriate nutritional counseling
9. Provide health education to individuals and families applying the principles and techniques of behavior change appropriate to community settings
10. Describe community health nursing approaches and concepts
11. Describe the role and responsibilities of community health nursing personnel
12. Utilize the knowledge and skills in providing comprehensive primary health care across the life span at various settings
13. Make effective home visits applying principles and methods used for home visiting
14. Use epidemiological approach in community diagnosis
15. Utilize the knowledge of epidemiology, epidemiological approaches in caring for people with communicable and non-communicable diseases
16. Investigate an epidemic of communicable diseases
17. Assess, diagnose, manage and refer clients for various communicable and non- communicable diseases appropriately at the primary health care level
18. Identify and perform the roles and responsibilities of nurses in implementing various national health programs in the community for the prevention, control and management of communicable and non-communicable diseases particularly in screening, identification, primary management and referral to a health facility/First Referral Unit (FRU)

COURSE OUTLINE

T – Theory

Unit	Time (Hrs)	Learning Outcomes	Content	Teaching/Learning Activities	Assessment Methods
I	4 (T)	Define public health, community health and community health nursing Explain the evolution of public health in India and scope of community health nursing Explain various concepts of health and disease, dimensions and determinants of health Explain the natural history of disease and levels of prevention Discuss the health	**Concepts of Community Health and Community Health Nursing** • Definition of public health, community health and community health nursing • Public health in India and its evolution and Scope of community health nursing • *Review:* Concepts of Health & Illness/ disease: Definition, dimensions and determinants of health and disease • Natural history of disease • Levels of prevention: Primary, Secondary &	• Lecture • Discussion • Explain using chart, graphs • Community needs assessment (Field survey on identification of demographic characteristics, health determinants and resources of a rural and an urban community) • Explain using examples	• Short answer • Essay • Objective type • Survey report

Unit	Time (Hrs)	Learning Outcomes	Content	Teaching/Learning Activities	Assessment Methods
		problems of India	tertiary prevention – Review • Health problems (Profile) of India		
II	8 (T)	Describe health planning and its steps, and various health plans, and committees Discuss health care delivery system in India at various levels Describe SDGs, primary health care and comprehensive primary health care (CPHC) Explain health care policies and regulations in India	**Health Care Planning and Organization of Health Care at various levels** • Health planning steps • Health planning in India: various committees and commissions on health and family welfare and Five Year plans • Participation of community and stakeholders in health planning • Health care delivery system in India: Infrastructure and Health sectors, Delivery of health services at sub-centre (SC), PHC, CHC, District level, state level and national level • Sustainable development goals (SDGs), Primary Health Care and Comprehensive Primary Health Care (CPHC): elements, principles • CPHC through SC/Health Wellness Center (HWC) • Role of MLHP/CHP • National Health Care Policies and Regulations ○ National Health Policy (1983, 2002, 2017) ○ National Health Mission (NHM): National Rural Health Mission (NRHM), National Urban Health Mission (NUHM), NHM ○ National Health Protection Mission (NHPM) ○ Ayushman Bharat ○ Universal Health Coverage	• Lecture • Discussion • Field visits to CHC, PHC, SC/ Health Wellness Centers (HWC) • Directed reading	• Short answer • Essay • Evaluation of Field visit reports & presentation
III	15 (T)	Identify the role of an individual in the	**Environmental Science, Environmental Health, and**	• Lecture	• Short answer

Unit	Time (Hrs)	Learning Outcomes	Content	Teaching/Learning Activities	Assessment Methods
		conservation of natural resources Describe ecosystem, its structure, types and functions Explain the classification, value and threats to biodiversity Enumerate the causes, effects and control measures of environmental pollution Discuss about climate change, global warming, acid rain, and ozone layer depletion Enumerate the role of an individual in creating awareness about the social issues related to environment	**Sanitation** • *Natural resources:* Renewable and non-renewable resources, natural resources and associated problems: Forest resources, water resources, mineral resources, food resources, energy resources and land resources • Role of individuals in conservation of natural resources, and equitable use of resources for sustainable lifestyles • *Ecosystem:* Concept, structure and functions of ecosystems, Types & Characteristics – Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem, Energy flow in ecosystem • *Biodiversity:* Classification, value of bio-diversity, threats to biodiversity, conservation of biodiversity • *Environmental pollution:* Introduction, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, nuclear hazards & their impact on health • *Climate change, global warming:* ex. heat wave, acid rain, ozone layer depletion, waste land reclamation & its impact on health • *Social issues and environment:* sustainable development, urban problems related to energy, water and environmental ethics • Acts related to environmental protection and preservation **Environmental Health &**	• Discussion • Debates on environmental protection and preservation • Explain using Charts, graphs, Models, films, slides • Directed reading • Visits to water supply & purification sites	• Essay • Field visit reports

Unit	Time (Hrs)	Learning Outcomes	Content	Teaching/Learning Activities	Assessment Methods
			Sanitation		
		List the Acts related to environmental protection and preservation	• Concept of environment health and sanitation		
			• Concept of safe water, sources of water, waterborne diseases, water purification processes, household purification of water	• Observe rain water harvesting plants	
		Describe the concept of environmental health and sanitation	• Physical and chemical standards of drinking water quality and tests for assessing bacteriological quality of water		
			• Concepts of water conservation: rain water harvesting and water shed management	• Visit to sewage disposal and treatment sites, and waste disposal sites	
		Describe water conservation, rain water harvesting and water shed management	• Concept of Pollution prevention		
			• Air & noise pollution		
			• Role of nurse in prevention of pollution		
		Explain waste management	• Solid waste management, human excreta disposal & management and sewage disposal and management		
			• Commonly used insecticides and pesticides		
IV	7 (T)	Describe the various nutrition assessment methods at the community level	**Nutrition Assessment and Nutrition Education**	• Lecture	• Performance assessment of nutrition assessment for different age groups
			• *Review of Nutrition*	• Discussion	
			○ Concepts, types	• Demonstration	
			○ Meal planning: aims, steps & diet plan for different age groups	• Role play	
				• Market visit	
			○ Nutrition assessment of individuals, families and community by using appropriate methods	• Nutritional assessment for different age groups	• Evaluation on nutritional assessment reports
		Plan and provide diet plans for all age groups including therapeutic diet	• Planning suitable diet for individuals and families according to local availability of foods, dietary habits and economic status		
			• General nutritional advice		
		Provide nutrition counseling and education to all age groups and describe	• Nutrition education: purpose, principles & methods and Rehabilitation	• Lecture	• Short answer
				• Discussion	• Essay

Unit	Time (Hrs)	Learning Outcomes	Content	Teaching/Learning Activities	Assessment Methods
		the national nutrition programs and Identify early the food borne diseases, and perform initial management and referral appropriately	• *Review:* Nutritional deficiency disorders • National nutritional policy & programs in India **Food Borne Diseases and Food Safety** **Food borne diseases** • Definition, & burden, Causes and classification • Signs & Symptoms • Transmission of food borne pathogens & toxins • Early identification, initial management and referral **Food poisoning & food intoxication** • Epidemiological features/clinical characteristics, Types of food poisoning • Food intoxication-features, preventive & control measures • Public health response to food borne diseases	• Field visits to milk purification plants, slaughterhouse • Refer Nutrition module-BPCCHN Block 2-unit I & UNIT 5	• Field visit reports
V	6 (T)	Describe behaviour change communication skills Counsel and provide health education to individuals, families and community for promotion of healthy life style practices	**Communication management and Health Education** • Behaviour change communication skills ○ communication ○ Human behaviour ○ Health belief model: concepts & definition, ways to influence behaviour ○ Steps of behaviour change ○ Techniques of behaviour change: Guiding principles in planning BCC activity ○ Steps of BCC ○ Social and Behaviour Change Communication strategies (SBCC): techniques to collect social history from clients ○ Barriers to effective	• Lecture • Discussion • Role play • Demonstration: BCC skills • Supervised field practice • Refer: BCC/SBCC module (MoHFW & USAID)	• Short answer • Essay • Performance evaluation of health

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

(Declared as Deemed to be University u/s 3 of the UGC Act, 1956)

Regulations governing

Master of Science degree in Molecular Biology and Human Genetics (MSMH)

Under the Faculty of Allied Health and Basic Sciences

CURRICULUM & SYLLABUS
(2021)

POST BOX NO.62, TAMAKA, KOLAR – 563 101. KARNATAKA, INDIA.

Ph:+91- 08152-210604, 210605, 243003, 243009, Fax:08152-243008,

E- Mail: registrar@sduu.ac.in **Website:,** www.sduu.ac.in

MASTER OF SCIENCE IN MOLECULAR BIOLOGY AND HUMAN GENETICS

1. PROGRAMME DESCRIPTION

The Master of Science (M.Sc.) in Molecular Biology and Human Genetics is designed to provide the concepts and techniques of molecular biology and human genetics, with special emphasis on medical aspects of genetics. This includes the preparation of materials for study, importance of molecular alterations, chromosomal variations in structure and number in fields such as population genetics, evolution genetics and medical genetics. The programme trains students to be employable in genetic labs, biotech industries and academia.

2. PROGRAMME OBJECTIVES

The purpose of the programme is to converge the attitude of the student in to research skill in terms of providing a working knowledge of theoretical and practical aspects of molecular cell biology and human genetics. At the end of the programme, the student should be able to a explain the genetic basis of biological functions, explain the genetic basis of simple and complex diseases, evaluate chromosomal aberrations and genetic variations, perform cell culture based bioassays, Conceive and evaluate a novel scientific idea.

3. ELIGIBILITY FOR ADMISSION

A Pass in Bachelor degree in any branch of life sciences, medical laboratory technology, MBBS, BDS, BAMS, BHMS or other equivalent qualifications approved by SDUAHER with a minimum of second class securing at least 50% of the aggregative marks or in an examination recognized as equivalent there to for all the subjects and in case of SC/ ST; the minimum marks would be 40% as eligibility criteria.

4. METHOD OF SELECTION

Candidates are expected to appear for an entrance test to be conducted by the university department and thereafter an interview. Admission to the programme will be based purely on merit obtained in the entrance examination. Application forms and other details will be made available by the office of the Registrar on payment of the prescribed application fee or can be downloaded from the website of the Academy www.sduu.ac.in. In case of such downloaded applications, the application should accompany a Demand Draft for the prescribe fee drawn in favor of The Registrar, SDUAHER, payable at Kolar. The applications should be complete in all respects and should accompany copies of relevant marks cards, degree certificates, caste certificate and date of birth certificate. The date, venue and time of entrance examination will be notified in the website to the applicants as soon as it is fixed.

5. PROGRAMME DURATION

The programme comprises of 4 semesters. There will be a minimum of **90 working days** in each semester excluding holidays, vacations and days engaged for examination.

6. ATTENDANCE

- Every candidate should have attendance not less than 75% of the total classes conducted in theory and practical in each calendar year calculated from the date of commencement of the term to the last working day as notified by the Academy in each of the subject prescribed to be eligible to appear for the University Examination.

- Attendance shall be calculated from the total number of hours prescribed by SDUAHER.

- A candidate lacking in the prescribed attendance and progress in any subject (s) in theory or practical in the first appearance shall not be permitted to appear for that subject (s).

7. TEACHING HOURS

- Each subject paper shall include 50 hours of Theory.
- Where relevant, a subject paper may also include Practicals for a duration of 50 hours.
- Seminars and Journal Club shall be organised in conjunction with the subject papers.
- Subject seminars covering the syllabus shall be mandatory. Time table of the same shall be prepared such that atleast one seminar is held each week. HoD shall nominate a faculty member to moderate the seminars.
- Attendance and active participation of the students in the Journal Club presented by Research Scholars/ Faculty of the Department shall be encouraged.
- Assignment on topics related to the curriculum shall be given on weekly basis. A scheduled class shall be held to discuss the write-up.

Table 1: Distribution of teachings hours in each semester			
Sl. No.	**Paper**	**Teaching Hours**	
		Theory	Practicals
Semester I			
1	Cell Biology	60	60
2	Principles of Genetics	60	60
3	Anatomy	60	60
4	Biochemistry	60	60
5	AI Tools in Biomedical Research	15	-
6	Biosafety and Good Laboratory Practices	15	-
	Total	270	240
Semester II			
1	Molecular Basis of Human Diseases I	60	60
2	Physiology	60	60
3	Microbiology	60	60
4	Simulation-Based Learning in Skill Lab	15	-
5	Basic Environmental Toxicology	45	-
6	Project work	120	-
	Total	360	180
Semester III			
1	Medical Genetics	60	60
2	Molecular Biology Techniques	60	60
3	Research Methodology & Biostatistics	60	-
4	Central Laboratory Diagnostic Techniques	15	-
5	SWAYAM Portal: Subject Related to the Project Work	45	-
6	Project Work	180	-
	Total	420	120
Semester IV			
1	Genetics Engineering & Biotechnology	60	60
2	Molecular Basis of Human Diseases II	60	60
3	Basic Bioinformatics	15	-
4	Downstream processing	45	-
5	Project Work	200	-
	Total	380	120

7. EXAMINATION AND EVALUAITON

7.1 INTERNAL ASSESSMENT:

a. Regular periodic internal assessment examinations should be conducted throughout the programme. The number of assessments shall be decided by the department.

b. There should be a minimum of two internal assessments for both theory and practicals during each semester of the programme and average of two examination marks should be taken into consideration while calculating the marks for internal assessment.

c. The weightage given to the internal assessment is 25% out of the total marks assigned for a subject (200 marks).

d. Student must secure at least 50% of total marks fixed for internal assessment in a particular subject in order to be eligible to appear in the university examination of that subject.

7.2 ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION:

To be eligible to appear for University examination a candidate:-

a. Shall have undergone satisfactorily the approved course of study in the subject/subjects for the prescribed duration.

b. Shall have attended at least 75% of the total number of classes in theory and practical /clinical jointly to become eligible to appear for examination in those subject/subjects.

c. Shall secure at least 50% of total marks fixed for internal assessment in a particular subject in order to be eligible to appear in the University Examination of that subject.

d. Shall fulfil any other requirement that may be prescribed by the University from time to time

7.3 SCHEME OF EXAMINATION

a. Evaluation components and marks allotment to the respective group is given in Table 2.

b. All subjects in each semester will include a theory paper.

c. At the end of each semester, there will be one university examination on each paper for 100 marks.

d. The duration of the exam will be 3 hours.

e. The question paper for the theory exam shall follow the pattern given in Table 3.

f. Some subjects may also include a practical paper.

g. At the time of Practical Examination, the candidate shall submit to the examiners his/her laboratory notebook duly certified by the Head of the Department as a bonafide record of the work done by the candidate.

h. Semester IV examination will also include the evaluation of Project Report.

TABLE 2: SCHEME OF EVALAUTION

Sl. No.	Paper	Teaching Hours		Marks		Internal Assessment		Viva Voce	Total
		(T)	(P)	(T)	(P)	(T)	(P)		
	Semester I								
1	Cell Biology	60	60	80	80	20	20		200
2	Principles of Genetics	60	60	80	80	20	20		200
3	Anatomy	60	60	80	80	20	20		200
4	Biochemistry	60	60	80	80	20	20		200
5	AI Tools in Biomedical Research	15	-	20	-	-	-		20
6	Biosafety and Good Laboratory Practices	15	-	20	-	10	-		30
	Total	270	240	360	320	90	80		850
	Semester II								
1	Molecular Basis of Human Diseases I	60	60	80	80	20	20		200
2	Physiology	60	60	80	80	20	20		200
3	Microbiology	60	60	80	80	20	20		200
4	Simulation-Based Learning in Skill Lab	15	-	30	-	20	-		50
5	Basic Environmental Toxicology	45	-	40	-	20	-		60
6	Project work	120	-	-	-	-	-		
	Total	360	180	310	240	100	60		710
	Semester III								
1	Medical Genetics	60	60	80	80	20	20		200
2	Molecular Biology Techniques	60	60	80	80	20	20		200
3	Research Methodology & Biostatistics	60	-	80	-	20	-	-	100
4	Central Laboratory Diagnostic Techniques	15	-	30	-	20	-		50
5	SWAYAM Portal: Subject Related to the Project Work	45	-	40	-	20	-		60

6	Project Work	180	-	-	-	-	-		
	Total	420	120	310	160	100	40		610
				Semester IV					
1	Genetics Engineering & Biotechnology	60	60	80	80	20	20		200
2	Molecular Basis of Human Diseases II	60	60	80	80	20	20		200
3	Basic Bioinformatics	15	-	30	-	20	-		50
4	Downstream processing	45	-	40	-	20	-		60
5	Project Work	200	-	80	-	30	-		110
	Total	380	120	230	160	80	40		620
	GRAND TOTAL								2790

Table 3: Theory Question Paper Pattern			
Type of questions	**No of questions**	**Marks for each question**	**Total**
Long Essay	2	20	40
Essay	6	10	60
Total	8		100

7.4 CRITERIA FOR PASS

a. For declaration of pass in any subject in the University examination the candidates shall secure a minimum of 50 % of the marks in both in theory and practical components of the examination.

b. Theory component is the sum total of marks obtained in University Exam Theory + Internal Assessment Theory + University Exam Viva Voce.

c. Practical component is the sum total of marks obtained in University Exam Practicals + Internal Assessment Practicals.

d. A candidate not securing 50% marks in both theory and practical components of a subject shall be declared to have failed in that subject and is required to appear for both theory and practical again in the subsequent examination in that subject.
.

7.5 DECLARATION OF CLASS

a. A candidate having appeared in all the subjects in the same examination and passes that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed in the examination with **Distinction**.

b. A candidate having appeared in all the subjects in the same examination and passes

that examination in the first attempt and secures 60% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed examination in **First class**.

c. A candidate having appeared in all the subjects in the same examination and passes that examination in the first attempt and secures 50% of marks or more but less than 65% of grand total marks prescribed will be declared to have passed the examination in **Second class**.

d. A candidate having appeared in all the subjects in the same examination and passes that examination in the first attempt and secures 50% of marks will be declared to have **passed** the examination.

e. A candidate passing the university examination in more than one attempt shall be placed in pass class irrespective of the percentage of marks secured by him/her in the examination.

f. **Note:** Fraction of marks should not be rounded off for clauses (a), (b) and (c)

7.6 CARRYOVER / ELIGIBILITY FOR PROMOTION TO THE NEXT SEMESTER

a. Candidate shall be permitted to carry over the backlog subject till the completion of duration of the programme.

b. However, she/ he shall be declared passed in the programme only after successfully passing all the subject/ courses of all semesters of the post graduate programme.

7.7 MAXIMUM DURATION OF THE PROGRAMME

The maximum duration of the programme shall be four years from the date of admission. The candidate failing to complete the course within four years from the date of admission will be declared unfit to continue and will be discharged from the programme.

7.8 PROJECT REPORT AND EVALUATION:

a. Faculty member of the Department of grade Assistant Professor or above shall be assigned to each candidate to serve as Project Guide during Semester III.

b. Guide and student shall interact and develop a topic worthy of scientific investigation, prepare the necessary skills, materials and approvals (eg. ethics clearance). Preferably, the outcome of the project work should be publishable in a refereed journal.

c. The project shall commence in the semester III. The title of the topic should be approved by the Department during the Semester III so that the student is fully prepared to engage in project work in Semester IV in the allotted time.

d. The outcome of the project should be present in the form of a Project Report.

e. Project Report shall include the following section: Introduction, Objectives, Materials and Methods, Results, Discussion, Summary and Conclusions, Reference.

f. The report shall be in hard bound form, type set with double space and atleast 1 inch margins on all four sides.

g. Student, Guide and HoD shall certify the genuineness of the work.

h. The University shall arrange for evaluation of the submitted Project Report from an external examiner.

i. Evaluation scheme for the Project Report is given in Table 4

Table 4: Scheme for evaluation of Project Report

Sl. No.	Section	Marks Assigned
(A)	**Project Report**	**80**
I	Introduction	10
II	Review of Literature	10
III	Methodology	10
IV	Results	15
V	Discussion	15
VI	Conclusions	10
VII	Bibliography	10
(B)	**Viva Voce**	**20**
	TOTAL	**100**

Semester 1 - Paper 1 – Cell Biology
[Theory 50 hours, Practicals 50 hours]

Unit I: **Cell Organelle and Functions (15 hours)**

- Introduction
  - Cell theory and discovery
  - Comparison of prokaryotic and eukaryotic cells
  - Endosymbiotic theory
- Plasma Membrane
  - Organization
  - Transport across membrane
  - Mechanism of endocytosis and exocytosis
- Cytoskeleton:
  - Components and Functions (Cell motility & Cell shape)
  - Microfilaments
  - Intermediate Filaments
  - Microtubule
- Structure and functions of Cilia and Flagella
- Structure and functions Centriole
- Mitochondria: Ultrastructure, Chemiosmotic theory and Respiratory Chain Complexes (oxidative phosphorylation)
- Nucleus:
  - Components
  - Nuclear pore complex
  - Nucleolus
  - Biosynthesis of ribosome
- Structure and functions of peroxisomes and lysosomes, and their differences
- Structure and functions of Endoplasmic Reticulum and Golgi Complex, and their role in glycosylation
- Protein sorting (cytosolic, nuclear, secretory and membrane proteins).

Unit II: Cell cycle and its regulation (10 hours)

- Phases of cell cycle: Mitosis and Meiosis
- Regulation of cell cycle
- Cell cycle check points
- Role of cyclins and cyclin-dependant kinases in cell cycle regulation

Unit III: Chromatin (15 hours)

- Chromatin structure: Histones, DNA, Nucleosome and higher level organization
- Metaphase chromosome: Centromere, Kinetochore, Telomere and its maintenance
- Holocentric chromosomes and supernumerary chromosomes;
- Chromosomal domains (matrix, loop domains) and their functional significance
- Heterochromatin and euchromatin
- Position effect; Variegation; Boundary elements; Chromosome bandings
- Functional states of chromatin and alterations in chromatin organization
- Structural and functional organization of interphase nucleus
- Chromatin remodelling

Unit IV: **Cell Interaction and Signalling (10 hours)**

- Cell-Cell Interactions:
  - Cell adhesion molecules
  - Cellular junctions
  - Extracellular matrix

- Signal transduction:
    - Intracellular receptor and cell surface receptors;
    - Signalling via G-protein linked receptors (PKA, PKC, CaM kinase)
    - Enzyme linked receptor signalling pathways
    - Network and cross-talk between different signal mechanisms
    - Programmed cell death

REFERENCES

- Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walter P. Molecular Biology of the Cell, 5th ed; USA;2007
- Lodish H, Berk A, Kaise CA, Krieger M, Scott MP, Bretscher A, Polegh H, Matsudaira P; editors; Molecular Cell Biology; 6th ed; USA; 2008
- Verma PS, Agarwal VK. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. New Delhi: S Chand and Company; 2005.
- Weaver RF; Molecular biology; 2nd ed; The McGraw−Hill Companies, 2004
- Brandenberg O; Dhlamini Z; Sensi A; Ghosh K; Sonnino A; editors; Introduction to Molecular Biology and Genetic Engineering; Italy; 2011

LIST OF PRACTICALS

1. Biosafety and aseptic handling techniques.
2. Isolation of PBMCs by density gradient centrifugation
3. Cell viability assay by Trypan Blue method
4. Cytotoxicity assay
5. Adherent cell culture: changing of growth medium
6. Adherent cell culture: sub-culturing
7. Cryopreservation
8. Primary cell culture

Semester 1 - Paper 2 - Principles of Genetics
[Theory 50 hours, Practicals 50 hours]

Unit I: Mendelian Inheritance (10 Hrs)

- Definition of common terminologies: Allele, Phenotype, Genotype, Homozygous, Heterozygous, Hemizygous.
- Mendel's Experiments – Monohybrid Cross, Dihybrid Cross.
- Law of Dominance, Law of Segregation, Law of Independent Assortment
- Punnet Square, Pedigree Analysis
- Problems on Mendelian cross
- Chromosomal basis of sex determination:
    - Mechanism of sex determination in humans (SRY gene)
    - X-chromosome inactivation
- Multiple Alleles: Rh and ABO incompatibilities - HLA genes

Unit II: Population Genetics (5 Hrs)

- Hardy-Weinberg law Factors that disturb Hardy-Weinberg Equilibrium:
    - Stratification
    - Assortative Mating
    - Consanguinity
    - Inbreeding
    - Migration (Gene flow)
    - Genetic Drift
    - Selection (Heterozygote Advantage)

Unit III: Genome Organization (10 Hrs)

- Central dogma of molecular biology - overview of gene expression
- Organization of viral and bacterial genomes
- Organization of eukaryotic genome: structure of eukaryotic chromosomes, nucleosome, 30 nm fibre and its condensation into chromatin.
- Eukaryotic Gene Structure: Introns, Exons, Promoter, 5' and 3' Untranslated Regions (UTR) Structure of a eukaryotic gene.
- Gene Families, Pseudo-genes, Non-coding RNA genes
- Mitochondrial DNA and Cytoplasmic Inheritance
- Genetic Variation:
    - Unique and Repetitive DNA Sequences
    - Mutations - types
    - Difference between Mutation and Polymorphism
    - Types of Polymorphisms: Single Nucleotide Polymorphism, Indels (Microsatellite, Minisatellite/VNTR), Copy number variation

Unit IV: DNA Replication, Repair and Recombination (10 Hrs)

- Structure of DNA – A, B, Z and triplex forms
- Mechanism of replication in prokaryotes and eukaryotes: semiconservative – origin of replication - bidirectional - replication fork - enzymes and accessory proteins.
- DNA Repair and Recombination:
    - Types of DNA damages
    - Direct repair (photoreactivation),

- Single strand damage repair (Base Excision Repair, Nucleotide Excision Repair, Mismatch Repair)
- Double strand damage repair (homologous recombination – non- homologous end joining)
- Translesion DNA synthesis
- Transposons and DNA transposition
- Immunoglobulin gene assembly by recombination

Unit V: Transcription (8 Hrs)

- Overview of gene structure and gene expression
- Promoters – Enhancers (Inducible , Constitutive) - Operators – Silencers – RNA Polymerases-transcription factors
- Types of RNA – mRNA, rRNA, tRNA, catalytic RNA, noncoding RNA
- Mechanism – Initiation, elongation, termination
- mRNA splicing - nuclear export of mRNA – RNA editing
- Gene expression in bacteria: *lac*-operon, *trp*-operon (structure and regulation)

Unit VI: Translation (7 Hrs)

- Open Reading Frame (ORF) - Universal Genetic code – Wobble hypothesis – Degeneracy of codons – Start Codon – Terminator codon
- Ribosome structure
- Mechanism: Amino acid activation – Initiation – Elongation – Termination
- Protein folding
- Co- and Post-translational modifications
- Transport of proteins and molecular chaperones
- Protein turnover and degradation

REFERENCES

- Nussbaum RL, McInnes RR, Willard HF, Hamosh A. Thompson and Thompson Genetics in Medicine. 7th ed. Philadelphia: Saunders-Elsevier; 2007.
- Ahluwalia KB. Genetics. 2nd ed. New Delhi: New Age International Publishers; 2009
- Nelson DL, Cox MM. Leninger Principles of Biochemistry. 4th ed. W.H. Freeman
- Krebs JE, Goldstein ES, Kilpatrick ST. Lewin's Genes XI. Oxford: Oxford University Press; 2003.
- Tropp BE. Principles of Molecular Biology. Massachusetts: Jones & Bartlett Learning; 2014
- Verma PS, Agarwal VK. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. New Delhi: S Chand and Company; 2005.

LIST OF PRACTICALS

1. Media preparation
2. Lymphocyte culture
3. Lymphocyte harvest
4. Preparation of test slide (chromosomal spreads)
5. GTG banding
6. Determine the effect of phytohemagglutinin supplementation on the yield of chromosomal spread
7. Determine the effect of pre-harvest colchicine treatment on the quality of chromosomal spread
8. Determine the effect of pre-harvest hypotonic salt treatment on the quality of chromosomal spread
9. Determine the effect of trypsin treatment on the quality of G-banding
10. Determine the effect of incubation time on the quality of chromosomal spread
11. Determine the effect of fetal bovine serum on chromosomal spread
12. Determine the effect of cell culture medium on chromosomal spread

Semester 1 - Paper 3 – Anatomy
[Theory 50 hours, Practicals 50 hours]

UNIT I: Introduction (6 hrs)

Definition of anatomy & its divisions.
Terms of location, positions & planes.
Cell & its organelles.
Epithelium- definition, classification, describe with examples, functions.
Glands-classification, describe serous & mucous glands with examples.
Basic tissues- Epithelial tissue, Connective tissue, Muscular tissue & Nervous tissue. Classification with examples.

UNIT II: Locomotion & support (5 hrs)

Cartilages- types with example & histology.
Bone- classification, names of bone cells, parts of long bone, microscopy of compact bone, names of all bones, Vertebral column, Invertebral disc, Fontanelles of fetal skull.
Joints-Classification of joints with examples, synovial joint(in detail for radiology)
Muscular system- classification of muscular tissue & histology, Names of muscles of the body.

UNIT III: Cardiovascular system (6 hrs)

Heart- Size, Location, Chambers, Exterior & Interior, Blood Supply of Heart, Pericardium, Systemic & Pulmonary Circulation, Branches of Aorta, Common Carotid Artery, Subclavian Artery, Axillary Artery, Brachial Artery, Femoral Artery, Superficial Palmar arch, Internal Iliac artery, Peripheral pulse, Inferior Vena cava, Portal Vein, Great Saphenous vein, Dural Venous Sinuses.

UNIT IV: Lymphatic System (3 hrs)

Thoracic duct, Cisterna Chyli.
Histology of Lymphatic Tissues, Names of regional Lymphatics, Axillary & Inguinal Lymph nodes.

UNIT V: Gastro- Intestinal System (4 hrs)

Parts of GIT, Oral Cavity(lip, tongue with histology), Tonsil, Dentition, Pharynx, Salivary glands, Waldeyer's ring, Oesophagus, Stomach, Small & large intestine, Liver, Gall Bladder, Pancreas, Radiographs of Abdomen

UNIT VI: Peritoneum (1 hr)

Peritoneal folds Describe in brief

UNIT VII: Respiratory System (4 hrs)

Parts of Respiratory System, Nose, Nasal cavity, Larynx, Trachea, Lungs, Histology

of Trachea, lung & pleura, Names of Paranasal air sinuses, Bronchopulmonary Segments.

UNIT VIII: Urinary System (4 hrs)

Kidney, Ureter, Urinary bladder, male & female urethra, Histology of kidney, Ureter, Urinary bladder, Male & Female urethra.

UNIT IX: Reproductive System (3 hrs)

Parts of **male reproductive system**, testis, Vas deferens, epididymis, prostate(gross & histology) Parts of **female reproductive system**-uterus, Fallopian tubes, ovary (gross & histology) Mammary gland- gross.

UNIT X: Endocrine glands (4 hrs)

Names of all endocrine glands in detail on Pituitary gland, Thyroid gland, Parathyroid gland, Supra renal glands- (gross & Histology)

UNIT XI: Nervous System (4 hrs)

Neuron, Classification of CNS, Cerebrum, Cerebellum, Midbrain, Pons, medulla oblongata, Spinal cord with spinal, Nerve (gross & histology), Meninges, Ventricles & Cerebrospinal fluid, Names of basal nuclei, Blood supply of brain, Cranial nerves, Sympathetic trunk & Names of Parasympathetic ganglia.

UNIT XII: Sensory Organs (3 hrs)

Skin- Types**,** Histology, Appendages of Skin.
Eye- Parts of Eye & Lacrimal apparatus, Extra ocular muscles& nerve supply
Ear- Parts of Ear-External, Middle and inner ear and contents.

UNIT XIII: Embryology (3 hrs)

Spermatogenesis & oogenesis, Ovulation,
Fertilization.
Placenta & Fetal circulation.

Reference books

- Text book of Anatomy by B.D.Chowrasiya
- Text book of Anatom by Vishram Singh
- Text book of Anatomy by I. B. Singh

List of Practicals

SL. No.	Demonstration of gross features of following	Histology
1	Parts of the long bone, identification of the individual bone. Fontanelles of fetal skull.	Serous and mucus salivary glands
2	Name and identification of important and major muscles of the body	Cardiac muscle TS and LS of skeletal muscle
3	Pericardium, external and internal features of heart, blood supply of heart and identification of major blood vessels of the body	Hyaline, elastic and white fibro cartilage.
4	Lymph node	TS and LS of compact bone
5	Parts of GIT: oral cavity, stomach, duodenum, small intestine, large intestine, caecum and appendix, liver, gall bladder, pancreas.(radiographs of abdomen)	Lymph nodes
6	Important folds of peritoneum	Tongue, stomach
7	Respiratory system: nose, trachea, lungs	Trachea and lungs
8	Urinary system: kidney, urinary bladder	Kidney, ureter and urinary bladder
9	Male reproductive system: testes, epididymis, prostate.	testes, epididymis, prostate
10	Female reproductive system: uterus and fallopian tube, mammary gland	Ovary, uterus and fallopian tube
11	Thyroid and supra renal gland	Pituitary thyroid, parathyroid and supra renal gland
12	Spinal cord, brain stem, cerebellum. External features and interior cerebellum, blood supply of brain. ventricles and CSF of brain	Spinal cord cerebellum and cerebrum
13	Eye ball and extra ocular muscles with nerve supply.	LS of thick and thin skin
14	Demonstration of models of spermatogenesis and oogenesis, ovulation, fertilization, placenta and fetal circulation.	

Semester 1 - Paper 4 – Biochemistry
[Theory 50 hours, Practicals 50 hours]

UNIT I: Biomolecules (15 hrs.)
Carbohydrates

Lipids
Proteins
Nucleic Acids

UNIT II: Enzymes (4 hrs.)

UNIT III: Bioenergetics (3 hrs.)

UNIT IV: Vitamins (6 hrs.)

UNIT V: Digestion & Absorption (3 hrs.)

UNIT VI: Nutrition (3 hrs.)

UNIT VII: Biophysical Chemistry (6 hrs.)

PH, Buffers
Henderson's equilibrium
Colloidal Solutions
Donnan Membrane
Equilibrium
Osmosis, Diffusion, Viscosity
Isotopes
Water, electrolyte, Acid base Metabolism

UNIT VIII: Biochemical techniques (10hrs.)

Chromatography
Electrophoresis
Photometry/ Spectrophotometry
Centrifugation
Cell Organelle fractionation techniques

Reference books

- Lehninger Principles of Biochemistry by Albert L. Lehninger
- Biochemistry by Donald Voet
- Harper's Illustrated Biochemistry by Robert K. Murray

LIST OF PRACTICALS

GENERAL INSTRUCTIONS

1. Laboratory Hazards and First Aid

QUALTITATIVE ANALYSIS

2. Qualitative analysis of carbohydrate

3. Qualitative analysis of proteins

4. Qualitative analysis of Non- protein nitrogenous substances

5. Identification of unknown physiologically important substance

6. Qualitative analysis of normal urine

7. Analysis of abnormal constituents of urine

QUANITATIVE ANALYSIS

1. Principle of colorimetric and spectrophotometer

2. Estimation of blood sugar by O- toluidine/DNS/GOD-POD method

3. Estimation of blood urea by di-acetyl Monoxime method

4. Estimation of urine creatinine by jaffes method

5. estimation of serum in organic phosphate by fiske subbarao method

6. Estimation of serum total proteins by biurett method and calculation of A/G

7. Estimation of protein by Folin ciocalteus method

8. Estimation of serum ALT and AST by Reitman and franklin method

9. Estimation of serum cholesterol by ferric chloride acetic acid method

10. Chromatography (paper, thin layer, adsorption, ion exchange)

11. Electrophoresis, Agarose gel, SDS PAGE

12. Estimation of total carbohydrate by Anthrone method

13. Assay of trypsin and calculation of specific activity

CASE REPORTS

1. Normal values of common biochemical parameters

Semester 1 – Generic Elective – AI tools in Biomedical Research

[Theory/practical 15 hours]

Unit I: Databases (4 hours)

- Indexing databases
- Citation databases: Web of Science, Scopus etc.

Unit II: Research metrics (3 hours)

- Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
- Metrics: h-index, g index, i10 index, althmetrics

Unit III: Open access publishing (4 hours)

- Open access publications and initiatives
- SHERPA/RoMEO online resource to check publisher copyright and self-archiving policies
- Software tool to identify predatory publications developed by Savitribai Phule Pune University
- Journal funder/journal suggestion tools viz., JANE, Elsevier Journal Finder, Springer, Journal Suggester, etc.

Unit IV: Publications misconduct: group discussion (2 hours)

- Subject-specific ethical issues, FFP, authorship
- Conflict of interest
- Complaints and appeals: examples and fraud from India and abroad

Unit V: Publications misconduct: software tools (2 hours)

- Use of plagiarism software like Turnitin, Urkund and other open-source software tools

Semester 1 – Discipline specific elective course – Biosafety and Good Laboratory Practices

[Theory 15 hours]

UNIT I: Biosafety (7 hours)

- Principles of Biosafety
- Biological Hazards and Risk Assessment
- Biosafety Levels (BSL-1 to BSL-4)
- Biosafety Guidelines and Regulations

UNIT II: Good Laboratory Practices (8 hours)

- Introduction and Principles of Good Laboratory Practices
- Laboratory Design and Organization
- Standard Operating Procedures (SOPs)
- Personal Protective Equipment (PPE) and Hygiene Practices
- Waste Management

- Emergency Preparedness and Incident Reporting
- Laboratory Ethics and Documentation

References

1. World Health Organization (WHO). Laboratory Biosafety Manual, 4th Edition (2020) https://www.who.int/publications/i/item/9789240011311
2. Centers for Disease Control and Prevention (CDC) & NIH. Biosafety in Microbiological and Biomedical Laboratories (BMBL), 6th Edition (2020) https://www.cdc.gov/labs/BMBL.html
3. OECD Principles of Good Laboratory Practice. https://www.oecd.org/chemicalsafety/testing/good-laboratory-practiceglp.htm
4. National Institutes of Health (NIH). NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules. https://osp.od.nih.gov/biotechnology/nih-guidelines/
5. Cartagena Protocol on Biosafety to the Convention on Biological Diversity. https://bch.cbd.int/protocol
6. Indian Biosafety Rules & Regulations, Department of Biotechnology, Govt. of India http://dbtbiosafety.nic.in

Semester 2 - Paper 1 – Molecular Basis of Human Diseases I
[Theory 50 hours, Practicals 50 hours]

Unit I <u>Biochemical Genetics (20 Hours)</u>

- Inborn errors of metabolism – Enzymopathy - Enzyme Replacement Therapy

- Disorders of Carbohydrate Metabolism
    - Galactosemia
    - Hereditary Fructose Intolerance
    - Pyruvate Dehydrogenase Deficiency
    - Diabetes Mellitus

- Disorders of Amino Acid Metabolism
    - Phenylketonuria (PKU)
    - Alkaptonuria
    - Oculocutaneous albinism Type 1
    - Maple Syrup Urine Disease

- Disorders of Purine/Pyrimidine Metabolism
    - Lesch-Nyhan syndrome
    - Orotic aciduria
    - Xanthinuria

- Lysosomal Storage Disease
    - Lipid storage disorders
        - Sphingolipidoses (Gaucher's Disease, Niemann-Pick disease)
        - Gangliosidosis (Tay-Sachs disease)
    - Mucopolysacharidiosis (Hunter Syndrome, Hurler Syndrome)

- Glycogen Storage Diseases (Type I and Type II)
- Disorders of lipid metabolism: Familial hypercholesterolemia
- Urea cycle disorders

- Disorders of trace elements
    - Hereditary Hemochromatosis
    - Wilson's Disease

- Disorders of endocrine regulation
    - CongenitaI Adrenal Hyperplasia
    - Androgen Insenstivity Syndrome
    - Congenital Hypothyroidsim

Unit II <u>Cancer Genetics (20 Hours)</u>

- Introduction to Cancer Biology: Definition – Benign – Malignancy - Metastasis

- Properties of Cancer cell
    - Loss of Contact Inhibition
    - Anchorage Independent Growth
    - Aberrations in Cell Cycle Regulation
    - Aberrations in apoptosis
    - Telomerase Activation

- Stages of Oncogenesis
  - Tumor initiation, promotion and progression
  - Tumor angiogenesis

- Cancer causing genes
  - Oncogenes – Classification - Mechanism of Activation
  - Tumor Suppressor Genes (*p53, Rb*)
  - Knudson's Two-Hit Theory

- Carcinogens
  - Classification and Mechanism of Action
  - Physical (Radiation)
  - Chemical (DNA Modifying Agents, DNA Intercalators, Base Analogs)
  - Biological carcinogens

- Epigenetic Changes in Cancer
  - DNA Methylation
  - Histone Modification
  - Micro-RNA mediated gene silencing

- Role of Virus in Cancer
  - Viral Oncogenes
  - Role of HPV and Cervical Carcinoma

- Familial Cancers
  - Difference between familial and sporadic cancers
  - Hereditary Breast and Ovarian Cancer Syndrome
  - Hereditary Non-Polyposis Colorectal Cancer
  - Familial Adenomatous Polyposis

- Genetic Instability Syndromes:
  - Fanconi Anemia
  - Xeroderma Pigmentosum

- Cancer treatment:
  - Classification of chemotherapeutic agents and their mechanism of action
  - Common examples: Cisplatin, Vincristine, Taxol, 5-Fluorouracil, Methotrexate
  - Molecular Basis of Radiotherapy

Unit IV 10 Hours

- Disorders of the Blood System
  - Haemoglobin disorders: Thalassemia , Sickle Cell Anaemia
  - Disorders of Hemostasis: Haemophilia, Factor V Leiden
  - Porphyria

- Disorders of the Eye
  - Retinitis Pigmentosa
  - Color-blindness
  - Retinoblastoma

- Neuromuscular disorders
  - Spinal Muscular Atrophy
  - Duchene Muscular Dystrophy
- Disorders of immune system: Severe combined immune deficiency (SCID)

REFERENCES

- Nussbaum RL, McInnes RR, Willard HF, editors. Thompson & Thompson Genetics in Medicine. 7th ed. Philadelphia: Saunders-Elsevier; 2007.
- Rimoin DL, Pyeritz RE, Korf BR, editors. Emery and Rimoin's Essential Medical Genetics. 1st Indian ed. Oxford: Academic Press- Elsevier; 2013.
- Ahluwalia KB. Genetics. 2nd ed. New Delhi: New Age International Publishers; 2009.
- Nelson DL, Cox MM. Leninger Principles of Biochemistry. 4th ed. W.H. Freeman
- Scriver CR, Beaudet Al, Sly WS, Valle D, editors. The Metabolic and Molecular Bases of Inherited Diseases. 8th ed. McGraw-Hill; 2001.

LIST OF PRACTICALS

1. Genomic DNA isolation extraction from PBMC
2. Genomic DNA isolation extraction from human tissue sample
3. DNA quantification by UV spectrophotometry
4. Primer design
5. Polymerase Chain Reaction
6. Optimization of PCR annealing temperature
7. Optimization of $MgCl_2$ concentration for PCR
8. Effect of PCR Additives

Semester 2 - Paper 2 – Physiology

[Theory 50 hours, Practicals 50 hours]

(Marks given in brackets indicate the depth of each topic to be covered)

UNIT I: General Physiology (6 hrs.)

- Structure of cell and Cell organelles. (information)
- Principles of Homeostasis. (information)
- Transport Across cell membrane (essay)
- Fluid Compartments of the Body – classification and normal values. (3 marks)

UNIT II: Blood (5 hrs.)

- Composition & functions of blood. (5 mark)
- RBC – formation, function & anemia. (essay)
- WBC – Classification of WBCs and function of each. (5 mark)
- Platelets: Structure of Functions of platelets. (3 marks)
- Steps of platelet plug formation. (5 marks)
- Mechanism of coagulation and haemophilia (Essay)
- Plasma Proteins: List the plasma proteins & the functions. (5 marks)
- Blood Groups – basis of blood grouping, clinical importance. (5 marks)
- Anticoagulants: calcium chelating agents, Vitamin K antagonist (3 marks)

UNIT III: Nerve and muscle Physiology (5 hrs.)

- Structure & functions of a neuron (information)
- Function of neuroglia. (3 marks)
- Molecular basis of resting membrane potential (5 marks)
- Molecular basis of action potential.(5 marks)
- Structure of a neuromuscular junction, neuromuscular transmission and Myasthenia gravis. (Essay)
- List the properties of skeletal muscle (5 marks)
- Describe strength –duration curve. (3 marks)

UNIT IV: Renal System (5 hrs.)

- Peculiarities of renal function. (5 marks)
- Starling forces that help in filtration. (3 marks)
- Definition of GFR , normal value, and factors regulating GFR.(Essay)
- Glucose absorption in the proximal tubule. (5marks)
- Mechanism of concentration of urine. (5 marks)
- Action of ADH on renals.(3 marks)
- Innervation of bladder. 5 marks)
- Micturation reflex. (5 marks)

UNIT V: Digestive System (3 hrs.)

- Basic Structure of Digestive system.(Information)

Composition and Functions of

- Salivary secretion. (5 marks)
- Gastric secretion , phases and regulation with experimental evidence (Essay)
- Pancreatic secretion. (5 marks)

- Intestinal secretion. (3 marks)
- Functions of bile/liver. (5 marks)
- Gastro –intestinal movements: Law of gut. (3 marks)
  Mastication. (5 marks)
  Movements of Stomach. (3 marks)
  Movements of Colon (3 marks)
  Movements of small intestine . (3 marks)

UNIT VI: <u>Endocrinology (5 hrs.)</u>

- Mechanism of action of hormones: (essay)
- List the hormones secreted and the functions of pituitary gland: and name the disease associated with increase/decrease secretion (essay)
- Classify endocrine receptors. Describe the concept of up/down regulation. (5marks)
- List the function of thyroid hormone. (5 marks)
- List the functions of Insulin (5 marks)
- Name the disease associated with insulin deficiency: diabetes mellitus. (3 marks)
- List the functions of cortisol (5 marks)
- Give the cause of Cushing's syndrome (3 marks)

UNIT VII: <u>Reproductive system (3 hrs.)</u>

- Functions of testis /testosterone. (5 marks)
- Functions of Ovary/oestrogen/progesterone. (5 marks)
- Menstrual Cycle – hormonal, uterine and ovarian changes(5 marks)
- Spermatogenesis(5 marks)

UNIT VIII: <u>Cardiovascular System (5 hrs.)</u>

- Conducting system of Heart. (5marks)
- Pacemaker potential & the ions responsible. (3marks)
- Cardiac Ventricular action potential & ions responsible (5 marks)
- Classification of refractory period. (Information)
- Why cardiac muscle cannot be tetanized. (3marks)
- Define cardiac cycle & list the events of cardiac cycle. (5marks)
- Define cardiac output. Give the normal value. Factors regulating cardiac output (Essay)
- List the effects of autonomic nervous system on heart rate. (3marks)
- List the effects of sympathetic system on CVS: Increase in heart rate, contractility of heart, increase in stroke volume or blood pressure and vasoconstriction. (5marks)
- List the mechanisms of blood pressure regulation: baroreceptor reflex (5marks)
  - Chemoreceptor mechanism (information)
  - CNS ischemic response (information)
  - Renin-angiotensin- aldosterone mechanism. (5marks)
- Normal coronary circulation and list the factors regulating it. (5marks)
- ECG in lead II and cause of each wave. (5marks)
- Reynold's number. (3marks)
- Hagen Pousille's law. (3marks)

UNIT IX: <u>Respiratory system (4 hrs.)</u>

- Functional Anatomy. (Information)
- Mechanisms of normal respiration. (Essay)
- Compliance. (3marks)
- Functions of surfactant (3marks)

- Regulation of respiration. (Information)
- Transport of oxygen. (5marks)
- Oxygen dissociation curve and factors affecting it.(5marks)
- Transport of carbon dioxide (5marks)
- Regulation of respiration.(5marks)
- Definition of hypoxia and classification of hypoxia.(3marks)

UNIT X: Central Nervous system (4 hrs.)

- Organisation of nervous system.(information)
- Classify synapse and list the properties of synapse. (5marks)
- Draw a neat labelled diagram of a reflex arc. (3marks)
- Define receptor and list the properties of receptor. (3marks)
- List the functions of cerebral cortex(5marks)
- List the ascending tracts. (information)
- List the sensations carried by Dorsal column.(3marks)
- List the sensations carried by spinothalamic tract(3marks)
- List the functions of corticospinal tract(3marks)
- List the functions of cerebellum(3 marks)
- List the functions of basal ganglia(3 marks)
- List the function of CSF(3 marks)
- List the functions of hypothalamus(5marks)

UNIT XI: Special Senses (4 hrs.)

- Functional anatomy of eye. (information)
- Broadmans area for visual cortex (information)
- Types of Refractive errors- draw.
- Receptors of vision (3marks)
- Colour vision and colour blindness (3marks)
- Functional anatomy of ear (information)
- Functions of middle ear. (3marks)
- Traveling wave theory of hearing (3marks)
- Perception of loudness and pitch: amplitude and frequency (3marks)
- List the primary taste sensations. (3marks)

Reference books

- Review of medical physiology by Ganong
- Text book of Medical Physiology by Guyton
- Text book of Medical Physiology by Indhu Khurana

LIST OF PRACTICALS

1. Study of a compound microscope (a) parts of the microscope (b) formation of Image (c) Focusing of an object (d) precautions
2. An introduction to experiments on blood (a) collection of blood samples (b) commonly used anticoagulants (c) Haematological values for normal individuals (d) Haemocytometer (e) RBC and WBC pipettes (f) Improved Neubauers counting chamber
3. Determination of total erythrocyte count (RBC count)
4. Determination of total leucocyte count
5. Preparation of peripheral blood smear and determination of differential leucocyte count 6. Estimation of Haemoglobin
8. Determination of blood groups
9. Determination of bleeding time.
10. Determination of clotting time
11. Recording of systemic arterial blood pressure. (only demonstration)
12. Recording of pulse. (only demonstration)
13. Recording of Electrocardiogram (only demonstration)
14. Recoding of Lung functions. (only demonstration)
15. Recording of respiratory movements. (only demonstration)

Semester 2 - Paper 3 – Microbiology
[Theory 50 hours, Practicals 50 hours]

UNIT I: General Microbiology (25hrs.)

Microscopy.

Morphology of bacteria and other Microorganisms.
Nomenclature and classification of Microbes. Growth
and nutrition of bacteria.

Bacterial metabolism.
Sterilization and disinfection.
Bacterial toxins.
Isolation, description and identification of bacteria.
Antibacterial substances used in the treatment of infections and drug resistance in bacteria.

UNIT II: Immunology (14 hrs.)

Normal Immune system.
Innate Immunity.
Antigens.
Immunoglobulin.
Complement.
Antigen-Antibody reactions.
Cell Mediated Immunity.
Hypersensitivity.
Immunodeficiency.

UNIT III: Virology (6 hrs.)

The nature of Viruses.
Classification of Viruses.
Morphology, virus structure
Viral replication.
The genetics of Viruses.
Pathogenicity of Viruses.
Bacteriophages.

UNIT IV: Mycology (5 hrs.)

The morphology, Structure and reproduction in fungi.
Classification of Fungi.

Reference books

- Textbook of Microbiology by Ananthnarayana and Paniker
- Bailey and Scott's Diagnostic microbiology"
- Practical Microbiology by Mackie and McCartney

LIST OF PRACTICALS

1. Orientation to Microbiology
2. Microscopy
3. Sterilization instruments
4. Staining
5. Culture media
6. Culture methods
7. Antibiotic sensitivity testing
8. Laboratory diagnosis of bacterial infections
9. Serological techniques I
10. Serological techniques II
11. Laboratory diagnosis of viral infections
12. Laboratory diagnosis of fungal infections

Semester 2 – Generic Elective – Simulation-based learning in Skill lab

[Theory/practical 15 hours]

UNIT I: Foundations of Simulation-Based Learning (7 hours)

- Introduction to Simulation-Based Learning
- Theoretical Frameworks
- Types and Modalities of Simulation
- Instructional Design in Simulation
- Learning Objectives and Competency-Based Training
- Role of the Instructor/Facilitator

UNIT II: Simulation Practice, Debriefing, and Evaluation (8 hours)

- Teaching Basic Life Support Skills
- Simulation Session Execution
- Debriefing in Simulation
- Assessment Strategies Using Simulation
- Technology and Simulation Tools
- Challenges and Limitations
- Best Practices and Case Studies

References

1. **Rosen, K. R. (2008).** *The history of medical simulation.* Journal of Critical Care, 23(2), 157–166. https://doi.org/10.1016/j.jcrc.2007.12.004
2. **INACSL Standards Committee. (2021).** *INACSL Standards of Best Practice: Simulation.* https://www.inacsl.org/standards/
3. **Jeffries, P. R. (Ed.). (2022).** *Simulation in Nursing Education: From Conceptualization to Evaluation* (3rd ed.). Lippincott Williams & Wilkins.
4. **Gaba, D. M. (2004).** *The future vision of simulation in health care.* Quality and Safety in Health Care, 13(Suppl 1), i2–i10. https://doi.org/10.1136/qhc.13.suppl_1.i2 • **Kolb, D. A. (1984).** *Experiential Learning: Experience as the Source of Learning and Development.* Prentice Hall.
5. **Dieckmann, P. (2009).** *Simulation Settings for Learning in Acute Medical Care.* LIT Verlag Münster.

Semester 2 – Discipline specific elective course – Basic environmental toxicology [Theory 45 hours]

Unit I: (20 hours)

- Introduction to Environmental Toxicology
- Principles and Scope of Toxicology
- History and Types of Toxicology
- Toxicity (LD50, LC50)
- Hazards, Risk Assessment, Risk Ratio, Tolerance Limits
- Pesticide Toxicology: Classification, Resistance, Metabolism, Surveillance
- Heavy Metal Toxicology: Arsenic, Cadmium, Lead, Mercury, etc.
- Toxicology of Hydrocarbons

Unit II: (25 hours)

- Toxicity Testing: Bioassay, Selection of Test Organisms, Methodologies, Estimation of LC50
- Dose-Response Relationships: Graded, Quantal Responses, Time Action Curves
- Bio-transformation, Bio-accumulation, Bio-magnification
- Detoxification Mechanisms
- Industrial Toxicology
- Environmental Impact, Control Measures, Threshold Values, Acceptable Daily Intake
- Environmental Degradation and Control

Recommended Textbooks:

1. Environmental Toxicology by Cornelis A.M. (Kees) van Gestel Basic.
2. Basic Environmental Toxicology by Lorris G. Cockerham and Barbara S. Shane.
3. Principles of Toxicology: Environmental and Industrial Applications by Phillip L. Williams, Robert C. James, Stephen M. Roberts

Semester 3 - Paper 1 – Medical Genetics
[Theory 50 hours, Practicals 50 hours]

Unit I: Introduction to genetic disorders (10 Hours)

- Classification of genetic disorders: chromosomal – monogenic – polygenic (multifactorial) – prevalence of common genetic disorders
- Common indications for genetic testing
- Pedigree drawing – Pedigree analysis
- Factor affecting pedigree analysis (Reduced penetrance, Variable expressivity, Genetic and Phenotypic Heterogeneity)
- Risk calculation and risk assessment
- Dysmorphology: Malformations, Deformations, Disruptions
- Genetic counselling and its significance
- Ethical and legal issues in genetic testing

Unit II: Chromosomal disorders (15 Hours)

Numerical aberrations

- Autosomal trisomies: Trisomy 21 (Down syndrome), Trisomy 18 (Edwards's syndrome), Trisomy 13 (Patau syndrome).
- Aneuploidy - Causes - Types

Structural aberrations:

- Balanced and Unbalanced Rearrangements
- Deletion and Duplication
- Translocation - Reciprocal translocation, Robertsonian translocation,
- Inversion and Insertion
- Marker and Ring Chromosomes
- Isochromosomes and Dicentric Chromosomes
- Chromosome instability syndromes

Sex chromosome abnormalities:

- Trisomy of sex chromosomes: Triple X syndrome, Klinefelter syndrome, 47, XYY syndrome
- Monosomy (Turner syndrome)

ISCN Classification

- International System of Cytogenetic Nomenclature
- Karyotype designation
- Band resolution
- Sequence of chromosomal abnormalities in karyotype
- Normal chromosomal variants

Unit III: Inheritance patterns of monogenic disorders (5 Hours)

- Classification of inheritance patterns of monogenic disorders
- Autosomal dominant, incompletely dominant and recessive pattern
- Sex-linked: X and Y- linked dominant and recessive patterns
- Mitochondrial inheritance
- Uniparental disomy - Imprinting

Unit IV: Types of Genetic Tests (10 Hours)

- Classification of genetic tests
- Conventional Cytogenetics: GTG-banding, Q-banding, C-banding, Ag-NOR staining, High resolution banding, R-banding, T-banding.
- Molecular Cytogenetics: FISH, (Preparation of FISH probes, Chromsome painting), Array-Comparative Genomic Hybridization (Array-CGH)
- Molecular Tests - PCR-ARMS, PCR – RFLP, RT-PCR, DNA Sequencing by Sanger and NGS methods (Discuss only application of these techniques in genetic testing; Principles covered in Semester 2 - Paper 3)

Unit V: Advanced Medical Genetics (10 Hours)

Prenatal Genetics

- Indications for prenatal testing
- Methods of Prenatal Diagnosis: Invasive and Non-invasive testing
- Invasive tests: Amniocentesis – Chorionic Villus Sampling – Percutaneous Umbilical Blood Sampling
- Non-invasive tests: Maternal serum screening, Fetal DNA in Maternal Circulation
- Preimplantation Genetic Diagnosis (PGD)

Newborn screening

- Newborn screening and its significance
- Commonly tested disorders
- Testing methods

Genetic tests for cancer

- Philadelphia chromosome
- HER2

REFERENCES

- Nussbaum RL, McInnes RR, Willard HF, editors. Thompson & Thompson Genetics in Medicine. 7th ed. Philadelphia: Saunders-Elsevier; 2007.
- Rimoin DL, Pyeritz RE, Korf BR, editors. Emery and Rimoin's Essential Medical Genetics. 1st Indian ed. Oxford: Academic Press- Elsevier; 2013.
- Ahluwalia KB. Genetics. 2nd ed. New Delhi: New Age International Publishers; 2009
- Scriver CR, Beaudet Al, Sly WS, Valle D, editors. The Metabolic and Molecular Bases of Inherited Diseases. 8th ed. McGraw-Hill; 2001.

LIST OF PRACTICALS

1. Buccal smear for Barr Body
2. Identification of Human Chromosomes
3. Karyotyping of G-banded spreads
4. Q-banding
5. R-banding
6. T-banding
7. FISH Technique
8. Image acquisition and analysis of FISH preparations
9. Risk assessment of genetic disorders

Semester 3 - Paper 2 – Molecular Biology Techniques

[Theory 50 hours, Practicals 50 hours]

Unit I: *Techniques for DNA Analysis* (25 hours)

- PCR:
  - Principle
  - Components (Template DNA, Primers, dNTPs, Thermostable polymerase, Buffer with magnesium)
  - Steps (Denaturation, Annealing, Extension)
  - Applications
- General Properties of PCR Primer, Concept of DNA melting, T_m and GC content.
- Factors affecting specificity and efficiency of PCR: Annealing temp, Primer design.
- Types of PCR
  - Multiplex PCR
  - Reverse Transcriptase PCR
  - Hot-Start PCR
  - Touch-Down PCR
  - Nested PCR
- Real-Time PCR:
  - General Principles and Applications
  - SYBR Green Method
  - TaqMan Method
- DNA sequencing by Sanger method
- Next Generation Sequencing
  - General Principle & Applications
  - Whole Genome Sequencing
  - Exome Sequencing
  - Clinical Exome Sequencing
- Principles and Applications of Southern Blotting and Northern Blotting – DNA Probe.
- DNA microarray - Principle and Applications
- Multiplex Ligation Dependent Probe Amplification (MLPA) - Principle – Methods - Application
- Restriction Fragment Length Polymorphism (RFLP) - Principle – Methods
- Variable Number Tandem Repeat (VNTR) – DNA Fingerprinting – Technique – Application
- Application of the above techniques for detection of Point Mutations, Frame-shifts, Gene/Exon Deletion, Duplication and Amplification.

Unit II: *Techniques for Protein Analysis (25 hours)*

- Spectroscopy:
  - Lambert-Beer Law
  - Fluorescence Spectroscopy
  - Fluorophore
  - Fluorescence Microscopy
- Chromatography:
  - General principles
  - Ion-Exchange chromatography
  - Affinity chromatography
  - Size-exclusion chromatography

  - Hydrophobic-interaction chromatography
  - HPLC
- Flow Cytometry and Fluorescence activated cell sorting (FACS)
- Centrifugation – Ultracentrifugation
- PAGE
  - Principles and applications
  - Native-PAGE
  - SDS-PAGE
  - 2D-PAGE
- Western Blotting - Principle – Methods – Applications – Antibody probe
- Mass spectrometry:
  - Principle and Applications
  - LC-MS
  - MALDI-TOF

REFERENCES

- Hollas JM; Modern spectroscopy; 4th ed; John Wiley and Sons, Inc; England; 2004
- Mistry BD; A Handbook of Spectroscopic Data CHEMISTRY;1st ed; Oxford Book Company; India; 2009
- Wilson K; Walker J; Principle and techniques of bio-chemistry and molecular biology; 7th ed; New York; 2010
- Brown TA. Gene cloning and DNA Analysis: An introduction. 6th ed. Wiley; USA 2010)
- Glick BJ, Pasternak JJ, Pattn CL. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 4th ed; American Society for Microbiology; 2010

LIST OF PRACTICALS

1. Mutation analysis by RFLP method
2. Multiplex PCR
3. RT-PCR
4. DNA sequencing and analysis
5. HPV DNA testing by PCR
6. Micro Satellite Analysis
7. Mutation analysis by DNA Sequencing (Demonstration of Experiment + Identification of sequence variation and analysis of the impact of polymorphism/mutation on protein function).
8. Ammonium sulphate precipitation of protein and dialysis
9. Native- PAGE
10. SDS-PAGE
11. Chromatrography: paper, thin layer, column chromatography
12. Demonstration of HPLC
13. Absorption spectra of nucleic acids by using Nanodrop
14. Absorption spectra of Proteins by using Nanodrop

Semester 3 - Paper 3 – Biostatistics and Research Methodology
[Theory 50 hours]

Unit I: Biostatistics (25 Hours)

- Sampling – Definition of sampling, Random sampling, representative sampling, Types of sampling, Probability sampling, Non probability sampling techniques, SRS, Systematic Random Sampling, Cluster sampling, Non probability sampling, Purposive, convenient, snow ball sampling, Sample size, (1) sample size for estimation (2) Testing of hypothesis, sample size estimation for various study designs.
- Data – Types of data, Variables, Types of variables, Scaling techniques, methods of data collection. Presentation of data, Types of presentation of data, Tabular presentation, and simple frequency tables, cross tabulation, principles of tabulation. Diagrammatic and graphic presentations- for qualitative and discrete data, continuous data. Bar diagrams, pie chart, Histograms, frequency polygon, line graphs, orgies, scatter plots and Box plots.
- Descriptive statistics – Meaning of central tendency, purpose, measures of central tendency- Arithmetic mean, Median, mode, harmonic and geometric mean for ungrouped and grouped data. Dispersion – Meaning, purpose, measures of dispersion- Standard deviation, Coefficient of variation, range, and inter quartile range. Normal distribution, Confidence intervals.
- Correlation – Types, correlation coefficient, significance. Regression – Meaning, Model, Types of regression, Linear and multiple regression. Introduction to Logistic regression.
- Inferential Statistics – Meaning, Methods of drawing inference in (1) Estimation (2) Testing of hypothesis, Parametric methods- Types, requirements of parametric methods, types of tests used based on hypothesis, Tests- Student t test, Z-test, Variance ratio test (F-test).Non- parametric tests – Chi-square test, Fisher's Exact test, Mc.Nemars test, Wilcoxn, Mann Whitney U test.

Unit II: Research Methodology (25 Hours)

- Research hypothesis / Research question
    - Research question – Features (SMART)
    - Research hypothesis
    - Null hypothesis
- Review of literature
    - Need for Review of Literature
    - Sources of literature : Print and Digital formats
    - Types of literature
        - Journals
        - Magazines
        - Monographs
        - Text Books
    - Types of Journal Articles:
        - Research Article
        - Review Article
        - Case-report
    - Types of scientific analysis
        - Systematic review
        - Meta-analysis

- Electronic literature databases and search engines
    - PubMed
    - EMBASE
    - IndMED
    - Cochrane Library
- Use of Boolean operators, keywords and filters for searching electronic literature
- Bibliography - Reference writing styles

- ***Study Designs for Biomedical Research***
    - Pilot study
    - Observational study
        - Case Control Study
        - Cohort Study
        - Cross-Sectional Study
    - Experimental
        - Randomised Clinical Trials (RCT)
        - Non RCT
    - Preclinical studies
    - Clinical trials
    - Phases of clinical trials (Blinding, Randomization)
    - Nuremberg code
    - Declaration of Helsinki
    - Belmont principles
    - International Conference on Harmonization (ICH)
    - Good Clinical Practice (GCP)
    - Good Laboratory Practice (GLP)

REFERENCES

- Rothman K.J. Epidemiology. Oxford University Press. New York, 2002.
- Byrne D.W. Publishing your research paper; Transcontinental Printing Inc; Maryland, USA.
- Bijlani R.L. Medical Research. 1st ed; Jaypee Publishers; India; 2008.
- Goyal R.C. Research Methodology for Professionals. 1st ed, Jaypee Publishers, India; 2013.
- Bowers D. Medical statistics from scratch. 2nd ed; John Wiley and Sons Ltd, England; 2009.
- Kirkwood B.R, Sterne J.A.C; Medical Statistics;2nd ed; Blackwell Sciences; USA; 2003.
- Mahajan B.K; Methods in Bio-statistics; 7th ed; Jaypee Publishers; India;2010.

Semester 3 – Generic Elective – Central Laboratory Diagnostic techniques

[Theory/practical 15 hours]

The students will be posted in all departments of the central diagnostic laboratory services, RLJH&RC, Tamaka, Kolar.

- Blood Collection Unit (2 hour)
- Biochemistry (3 hour)
- Microbiology (3 hour)
- Pathology (3 hour)
- Hematology (2 hour)
- Virology (2 hour)

The students will learn the basic knowledge on tests/techniques/services provided for the patients in the hospital

Semester 3 – Discipline specific elective course – Basic environmental toxicology [Theory 45 hours]

SWAYAM portal: Subject Related to Project Work

Note: Students must enroll in a subject related to the project work on the SWAYAM portal and complete the course.

The course completion certificate should be submitted to the respective guide/supervisor and the department.

Semester 4 – Paper 1 - Genetic Engineering & Biotechnology
[Theory 50 hours, Practicals 50 hours]

Unit I: Recombinant DNA Technology (20 Hrs)

- Overview of recombinant DNA technology: Application of recombinant DNA technology
- Vectors:
  - General properties
  - Cloning vector
  - Expression vector
  - Types (Plasmid, Cosmid, Phagemid, BAC and YAC)
- Enzymes and their applications :
  - DNA Polymerase
  - Proof reading polymerase
  - Thermostable polymerase
  - Exonuclease
  - Restriction endonuclease and restriction digestion
  - DNA ligase – cohesive and blunt end ligation
  - Alkaline phosphatase
  - Polynucleotide kinase and end labelling.
- Transfer of foreign DNA into host cell
  - Transformation selection & screening of transformants
  - Antibiotic selection
  - Blue white assay
- Construction of genomic DNA and cDNA libraries
- Cloning of PCR Product
  - Addition of restriction
  - Sites to Primers
  - Ta Cloning
- Protein Tags for affinity purification:
  - His tag
  - GST tag
  - MBP tag
  - Ammonium sulphate precipitation
  - Inclusion bodies

Unit II: Genetic Manipulation (5 Hrs)

- Gene silencing : Principle – methods – Applications
- Gene knockout : Techniques for creation of knock out mouse - applications

Unit III: Protein Engineering (5 Hrs)

- Site – Directed mutagenesis – Principle – Methods - applications.
- PCR based Directed evolution of protein – Principle - Methods – applications
- Phage display technology

Unit IV: Molecular Therapeutics (15 Hrs)

- Cell based therapies :
  - Definition, properties, potency of stem cells.
  - Sources : Embryonic & adult stem.
  - Induced pluripotent cells (iPS cells)

- Clinical applications of stem cells.

- Recombinant therapeutics:
  - Protein Bio-similars: Insulin, Erythropoietin and Human Growth Hormone.
  - Thombolytic agents (streptokinase, tissue plasminogen activator)
  - Immunotherapeutics:
    - Targeted cancer therapy (mechanism of action of Trastuzumab, Cetuximab, Bevacizumab)
    - Anti-inflammatory therapeutics (mechanism of action of Etanercept, Infliximab, Adalimumab)
  - Recombinant vaccines & clinical application
- Gene Therapy:
  - General principles and overall mechanism
  - Intracellular barriers to gene delivery
  - Methods for gene transfer: viral (retrovirus, adenovirus) and non-viral (liposome, nanoparticle)
  - Genome editing: CSIPR-Cas9 technology
  - Examples of gene therapy
  - Limitations

Unit V: Intellectual Property Rights (5 Hrs)

- Principles of IPR
- Types of IPR
- Intellectual property infringement
- TRIPS agreement
- Criticism of IPR

REFERENCES

- Griffiths AJF, Wessler SR, Lewontin RC, Carroll SB; editors; Introduction to Genetic Analysis; 9th ed; USA; 2008
- Sambrook J, Russell DW; editors; Molecular Cloning; 3rd ed; Cold Spring Habor; New York; 2001
- Freshney RI; Culture of Animal Cells; 6th ed; John Wiley and Sons, Inc.;New Jersey; 2010
- Brown TA. Gene cloning and DNA Analysis: An introduction. 6th ed. Wiley; USA 2010)
- Glick BJ, Pasternak JJ, Pattn CL. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 4th ed; American Society for Microbiology; 2010

LIST OF PRACTICALS

1. Plasmid purification
2. Restriction digestion
3. DNA ligation
4. Transformation of recombinant construct
5. Blue-white screening of transformants

Semester 4 – Paper 2 - Molecular Basis of Human Diseases II
[Theory 50 hours, Practicals 50 hours]

Unit I: <u>Non-Mendelian Inheritance (20 Hrs)</u>

- Factors affecting Mendelain inheritance
- Interaction of alleles and genes:
  - Dominance: Complete dominance Incomplete dominance, Co-dominance, Overdominance (heterozygote advantage)
  - Epistasis and types of epistatic interactions (dominant epistasis, recessive epistasis, duplicate gene, additive genes, complementary genes, suppressor genes)
  - Modifier genes
  - Lethal genes

- Simple and Complex diseases:
  - Monogenic, and polygenic (multifactorial) traits
  - Pleiotropy
  - Types of polygenic inheritance (continuous and discontinuous)

- Gene and environment
  - Penetrance
  - Expressivity
  - Phenocopy

- Estimation of genetic component of multifactorial traits:
  - Risk Ratio
  - Heritability
  - Coefficient of Relationship
  - Familial Aggregation Studies
  - Twin Studies

- Genomic imprinting - Anticipation - Mosaicism & Chimerism

- Spontaneous mutations
  - Sources of spontaneous mutation (replication, recombination, chemical changes, transposons)
  - Factors affecting fixing of spontaneous mutation into familial mutation
  - Germline mutation rate in humans with common examples
  - Effect parental age and gender on the rate of spontaneous mutations

Unit II: <u>Genetic basis of diseases (15 Hrs)</u>

- Ion-channel Diseases: Cystic Fibrosis, Long QT Syndrome , Brugada Syndrome
- Skeletal and connective tissue disorders: Achondroplasia, Marfan Syndrome
- Hearing disorders: Non-syndromic Hearing Loss (*GJB2* gene mutations)
- Kidney disorder: Polycystic Kidney Disease
- Triplet repeat expansion disorder: Huntington disease, Fragile X syndrome, Myotonic dystrophy
- Multifactorial Disorders: Alzheimer's Disease, Age related macular degeneration
- Multifactorial Congenital Malformations – Neural tube defects, Cleft lip/palate, congenital heart malformation
- Disorders due to Genomic Imprinting – Uniparental Disomy: Beckwith Wiedemann Syndrome, Prader Willi syndrome, Angelman syndrome

- Mitochondrial Disorders

Unit III: Gene Mapping (5 Hrs)

- Linkage and Crossing Over
- Genetic markers
- Two point mapping – Multipoint Mapping
- Recombination frequency - Map distance - LOD Analysis
- Linkage map

Unit IV: Identification of human disease genes (5 Hrs)

- Human Genome Project
- Positional Cloning
- Candidate Gene approach
- Genome Wide Association Studies

Unit V: Pharmacogenetics (5 Hrs)

- Brief overview of drug metabolism
- Genetic polymorphisms of drug metabolising enzymes:
    - Pseudocholinesterase deficiency
    - N-Acetyl Transferase polymorphism and isoniazid adverse reaction
- Genetic polymorphisms of drug target :
    - G6PD deficiency and drug induced hemolysis
    - Vitamin K Epoxy Reductase Complex 1 and warfarin dosage
- Role of pharmacogenetics in personalised medicine

REFERENCES

- Nussbaum RL, McInnes RR, Willard HF, Hamosh A. Thompson and Thompson Genetics in Medicine. 7th ed. Philadelphia: Saunders-Elsevier; 2007.
- Ahluwalia KB. Genetics. 2nd ed. New Delhi: New Age International Publishers; 2009
- Verma PS, Agarwal VK. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. New Delhi: S Chand and Company; 2005.
- Nelson DL, Cox MM. Leninger Principles of Biochemistry. 4th ed. W.H. Freeman

LIST OF PRACTICALS

1. Polymorphism and Pharmcogenetics: Analysis of promoter SNP of *VKORC1* gene
2. Mutation and Pharmacogenetics: analysis of *BCHE* gene
3. Mutational analysis of Achondroplasia (*FGFR3* gene)/Cystic Fibrosis (*CFTR* gene)
4. Mutational analysis of Non-Syndromic Hearing Loss (*GJB2* gene).
5. Allele specific PCR for Beta-thalassemia 619 bp deletion
6. Mutational analysis of *HBB* gene by Sanger Sequencing
   (All experiments shall include an analysis of the impact of polymorphism/mutation on protein function)

Semester 4 – Generic Elective – Basic Bioinformatics
[Theory/practical 15 hours]

Biological Literature Information access:
Origins and History - Main Sub-disciplines of Bioinformatics, Knowledge on freeware and commercial software. Importance of hardware and software creations. Sequencing Databases.

Genomic databases
Definition & types, Eukaryotic and prokaryotic genomes. NCBI TOOLS, EMBOSS, FASTA, and BLAST.

Phylogenetic Analysis: Phylogenetics data analysis, Tree building methods, Rooted tree, unrooted tree, Distance method, UPGMA, NJ, Fitch- Margoliash, Minimum Evolution, Character-based methods - Maximum Likelihood and Maximum Parsimony methods, Software's: Phylip. Molecular Clocks and Estimation of Divergence Time.

Protein sequence analysis: using software's: Emboss, Data mining proteomes, Motif mapping using Prosite, Prodom, protein expression profiling, protein-protein No. of Hours / Week Credits 4 4 48 interactions, protein complexes.

Docking methods: introduction, three-dimensional descriptions of binding site environment and Energy calculation, Automatic Docking Method, Three-Dimensional database search Approaches, Design of ligands, Drug-receptor interactions automated structure Construction methods, AUTODOCK.

Recommended Textbooks and References

1. Bioinformatics and Functional Genomics by Pevsner, J., John Wiley and Sons, New Jersey, USA. 2003.
2. Principles of Genome Analysis and Genomics (3rd Ed.) by Primrose, S.B. and Twyman, R.M., Blackwell Publishing Company, Oxford, UK.
3. Introduction to proteomics – Tools for the new biology (1st Ed.) by Liebler, D.C., 2002, Human Press Inc., New Jersey, USA.
4. Bioinformatics: Sequence and Genome Analysis by Mount, D., Cold Spring Harbor Laboratory Press, New York. 2004.

Semester 4 – Discipline specific elective course – Downstream Processing [Theory 45 hours]

Unit I:

- Introduction to Downstream Processing
- Principles and Characteristics of Biomolecules
- Pretreatment and Stabilization of Bioproducts
- Unit Operations for Solid-Liquid Separation: Filtration (batch, continuous), Clarification,
- Flocculation, Centrifugation
- Cell Disruption Methods: Mechanical, Chemical, Enzymatic, High-Pressure Homogenization,
- Microfluidization

Unit II

- Concentration of Biological Products: Evaporation, Membrane Filtration, Electrodialysis, Pervaporation
- Isolation and Purification: Liquid-Liquid Extraction, Aqueous Two-Phase Extraction, Precipitation, Adsorption, Supercritical Fluid Extraction
- Chromatography: Principles, Types (Adsorption, Ion-Exchange, Size Exclusion, Affinity,

Hydrophobic Interaction)

- Product Formulation: Drying, Lyophilization, Crystallization
- Bioprocess Monitoring and Integration

Recommended Textbooks:

1. Bioseparations – Downstream Processing for Biotechnology by P.A. Belter, E.L. Cussler, Wei-Houhu
2. Bioprocess Engineering: Downstream Processing by Pau Loke Show, Chien Wei Ooi, Tau Chuan Ling
3. Principles of Downstream Techniques in Biological and Chemical Processes by Raja Ghosh

CHAPTER- I: REGULATIONS

1. Short Title and Commencement

These regulations shall be called as "The Revised Regulations for the B. Pharm. Degree Program (CBCS)of the Pharmacy Council of India, New Delhi". They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by Pharmacy Council of India.

2. Minimum qualification for admission

2.1 First year B. Pharm:

Candidate shall have passed 10+2 examination conducted by the respective state/central government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry, Mathematics (P.C.M) and or Biology (P.C.B / P.C.M.B.) as optional subjects individually. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

2.2. B. Pharm lateral entry (to third semester):

A pass in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the program

The course of study for B.Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semestershall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week.

Credit assignment

Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Projectover the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of ‘Communication Skills’ (Theory and Practical) and ‘Computer Applications in Pharmacy’ (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

8. Academic work

A regular record of attendance both in Theory and Practical shall be maintained by the teaching staff of respective courses.

9. Course of study

The course of study for B. Pharm shall include Semester Wise Theory & Practical as given in Table – I to VIII. The number of hours to be devoted to each theory, tutorial and practical course in any semester shall not be less than that shown in Table – I to VIII.

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
	Total	**32/34$/36#**	**4**	**27/29$/30#**

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course**.**

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course**.**

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
	Total	**32**	**4**	**29**

*****Non University Examination (NUE)

Table-III: Course of study for semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
	Total	**28**	**4**	**24**

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
	Total	**31**	**5**	**28**

Table-V: Course of study for semester V

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial PharmacyI– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial PharmacyI – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	**27**	**5**	**26**