



Vel Tech

Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Est. u/s 3 of UGC Act, 1956)

**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**




S.No	Name	Position	Signature
1	Prof.S.Salivahanan Vice Chancellor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Chairperson	S. Salivan
2 ✓	Prof. R. Venkata Rao (Former Vice Chancellor,National Law School of Indian University, Bangalore) Chairperson, Vivekananda School of Law & Legal Studies & Vivekananda School of English Studies.	External Member	PRESENT
3 ✓	Prof. N. V. Ramana Rao Director,National Institute of Technology Warangal, Telangana -506004.	External Member	PRESENT
4 ✓	Dr. OR. Nanda gopan Director, DRDO Industry Academia Ramanujan Centre of Excellence (DIA-RCoE) IITM, Research Park, Chennai.	External Member	PRESENT
5	Dr. Shankar Venugopal Vice President, Technology Innovation & KM Dean - Mahindra Technical Academy Mahindra World City, Chengalpattu, TamilNadu.	External Member	ABSENT
6 ✓	Mr.Ramakrishna Chief Executive Officer and Managing Director, Effronics Systems Pvt. Ltd., Vijayawada	External Member	PRESENT



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S.No	Name	Position	Signature
7 ✓	Dr. K. Sankaranarayananasamy, Director, National Institute of Technology (NIT), Puducherry	External Member	PRESENT
8	Prof. Dr. Krishnan Baskar. D.Sc. (KTH-Sweden), FRSC(London). Director, Indian Institute of Technology- Senapati, Manipur Mantripukri, Imphal	External Member	ABSENT
9	Dr.Carmel Mary Belinda M J Dean (Academics i/c), Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
10	Dr.R.S.Valarmathi Dean (Quality Assurance), Professor, Dept of Electronics and Communication Engineering VelTech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member	
11	Dr. P. Chandrakumar Dean (Industry Relations), Professor, Dept of Mechanical Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member	



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S.No	Name	Position	Signature
12	Dr.M.Sivakumar Dean (FME), Professor, Dept of Mechanical Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
13	Dr.P.Suresh Dean (International Relations), Professor, Dept of Electronics and Communication Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member	
14	Mr.P.Vijayaraman Dean -In charge (Campus to Corporate), Assistant Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member	
15	Dr.S.Irudayaraj Dean(SOMC), Professor, Dept of Mechanical Engineering Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology.	Ex-officio	
16	Dr.V.Jayasankar Dean(SOE), Professor, Dept of Electrical and Electronics Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	



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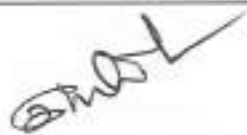


S.No	Name	Position	Signature
17	Dr.A.Subrahmanyam Dean(SOL), Professor, Dept of Law, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	ARCENT
18	Dr.V.Srinivasa Rao Dean, (i/c) & Head – Computer Science & Engineering, Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	
19	Dr.S. Koteeswaran Dean (Research), Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology.	Internal Member	
20	Dr. M.S.R. Mariyappan, Dean (School of Management), Professor, Dept of MBA, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology	Internal Member	
21	Dr.E.Suresh Paul Dean - Media Technology & Communication, Professor, VelTech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology.	Ex-officio	



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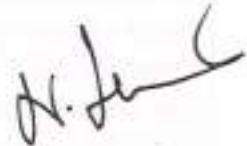
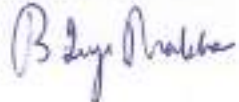
S.No	Name	Position	Signature
22	Dr.E.Balasubramanian DIND, Professor, Dept. of Mechanical Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
23	Dr. R. Sivaraman Controller of Examinations, VelTech Rangarajan Dr.Sagunthala R & D Institute of Science andTechnology.	Permanent Invitee	
24	Dr. R. Jaganraj Associate Professor, Head – Aeronautical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
25	Dr.Amala Justus Selvam Head –Automobile Engineering, Professor, Dept of Automobile Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
26	Dr. A. Geetha Selvarani, Head – Civil Engineering, Professor Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member	



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S.No	Name	Position	Signature
27	Dr.P.Chandrasekar Head-Electrical & Electronics Engineering, Professor, Dept of Electrical & Electronics Engineering Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology.	Ex-officio	
28	Dr.P.Esther Rani, Head - Electronics & Communication Engineering, Professor, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai-62.	Ex-officio	
29	Dr.C.Mahesh Head-Information Technology, Professor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
30	Dr. N. Lenin, Head - Mechanical Engineering, Professor, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology,	Ex-officio	
31	Dr.B.Jeya Prabha Professor, Head - Business Administration, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	



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S.No	Name	Position	Signature
32	Ms.J.Sri Devi Head – Commerce and Business Administration, Assistant Professor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
33	Dr.M.L.Suresh Head –Mathematics, Professor, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	
34	Dr. Senthil Kumar Head - Physics, Associate Professor, VelTech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology.	Ex-officio	
35	Dr.CH.Hazarathaiyah Yadav Head-Chemistry, Professor, Vel Tech Rangarajan Dr. Sagunthala R &D Institute of Science and Technology.	Ex-officio	ABSENT
36	Dr. M.R.Bindu Head-English, Professor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
37	Dr.N.M. MasoodhuBanu Head/c –Bio Medical, Professor Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	



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38	Dr.V.R.Manoj Head i/c- BioTechnology, Professor Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	
39	Dr.S.Samson Professor, Dept of Civil Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
40	Dr.N.Gomathi Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	ABSENT
41	Dr.Malarvizhi N Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
42	Dr.P.K.Dhal Professor, Dept.of Electrical and Electronics Engineering Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science andTechnology.	Internal Member Representing as Professor	



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S.No	Name	Position	Signature
43	Dr. J.L.Mazher Iqbal Professor, Dept.of Electronics and Communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
44	Dr. V. Sundara pandian Professor, Dept.of Mathematics Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	<i>V.Sundara Pandia</i>
45	Dr. E. Chandrasekaran Professor, Dept.of Mathematics Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member Representing as Professor	<i>E.Chandrasekaran</i>
46	Dr. M. Kavitha Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	<i>kvitha</i>
47	Dr.G.Sasikala Professor, Dept.of Electronics and Communication Engineering Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science andTechnology.	Internal Member Representing as Professor	<i>gs</i>



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S.No	Name	Position	Signature
48	Dr.R.Kavitha Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
49	Dr.V.S.Hemakumar Professor, Dept.of Electronics and Communication Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
50	Dr.C.T.Dora Pravina Associate Professor, Dept.of Mathematics, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Associate Professor	
51	Dr. D.Kanagajothi Associate Professor, Dept.of Mathematics, VelTech Rangarajan Dr.Sagunthala R & D Institute of Science andTechnology.	Internal MemberRepr esenting asAssociate Professor	
52	Dr.S.Prabakaran Chief Librarian, VelTech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member	ABSENT
53	Dr.E.Kannan Registrar, Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R &D Institute of Science and Technology.	Secretary	



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**FORTIETH MEETING
OF
THE ACADEMIC COUNCIL**

Saturday, October 08, 2022

MINUTES

S. Selvam

Prof. S. Sallvahtanan
Vice Chancellor

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

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Prof. S. Sathiyamoorthy
S. Sathiyamoorthy
Director

40.13	To ratify the number of students admitted for various programme for the Academic Year 22-23.	12
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S. Sahim

Prof. S. Sathyanarayanan
Vice-Chancellor





MINUTES OF THE 40th MEETING OF THE ACADEMIC COUNCIL

Friday, October 8, 2022, at
10.30 a.m.

The Vice Chancellor welcomed all the members along with two new external members and highlighted the achievements of the Institution deemed to be university.

A. Opening

40.1 Call to Order and Approval of Agenda of the 40th meeting of the Academic Council.

The Chairperson called to order and placed the agenda for confirmation which was circulated to members by e-mail.

The Council confirmed the agenda.

40.2 Confirmation of the minutes of 39th meeting of the Academic Council held on Friday, May 06, 2022.

The minutes of the 39th meeting of the Academic Council held on May 06, 2022 were circulated to the members.

The draft minutes of the 39th meeting of the Academic Council can be accessed [here](#)



Appendix A

The minutes were confirmed.

40.3 To review the Action Taken Report on the minutes of the 39th meeting of the Academic Council held on May 06, 2022.

The Vice Chancellor, placed before the Academic Council to consider the Action Taken Report in respect of the 39th meeting of the Academic Council as described in Table 1.

Table 1: Action Taken Report in respect of 39th meeting of the Academic Council held on May 06, 2022.

S.No	Decision Taken	Action Taken Report
1	Item No 39.05 - Page 02 To consider and approve the minutes of Board of Studies	Text book and Reference book Included with proper format.

The Council approved the Action Taken Report.

S. Salivan
Prof. S. Salivanan
Vice Chancellor

40.4 To record leave of absence of the members.

The following members expressed their inability to attend the meeting.

- * **Dr. Shankar Venugopal**
Vice President, Technology Innovation & KM,
Dean – Mahindra Technical Academy Mahindra World City.
- * **Prof. Dr. Krishnan Baskar,**
D.Sc. (KTH-Swedan), FRSC (London),
Director, Indian Institute of Technology-Senapathi.
- * **Dr. A.Subrahmanyam,**
Dean (SOL), Professor, Dept of Law,
Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.
- * **Dr. S.Prabakaran,**
Chief Librarian,
Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.
- * **Dr. N.Gomathi,**
Professor, Dept. of Computer Science and Engineering,
Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.
- * **Dr.CH.Hazarathaiyah Yadav,**
Head-Chemistry, Professor, Dept of Chemistry
Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.

The list of members attended the 40th meeting of the Academic Council can be accessed [here](#)



Appendix Attendance

The Chair has noted their leave of absence.

B. Items for Discussion

40.5 To discuss on the introduction of PG Diploma courses and certification courses by Vel Tech TBI in collaboration with Industry Partners.

The Vice Chancellor, placed before the Academic Council to discuss and approve the PG Diploma programmes to be offered for the Academic Year 2022-23.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, presented the introduction of PG Diploma courses and certification courses by Vel Tech TBI in collaboration with Industry Partners.

S. Selim
Prof. S. Sathya Kumar
Vice Chancellor

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Mahindra World City, Chennai-600 095

Boston IT Solutions

1. PG Diploma in Data Science and Applied Artificial Intelligence (6 months/200 hours)
2. PG Diploma in Big Data Engineering (6 months/200 hours).

Certification programs (15 Hours)

1. Python for Data Science (15 Hours)
2. Data Science with SQL (15 Hours)
3. Data Science with Excel (15 Hours)
4. Introduction to AI (15 Hours)

* A few members were of the opinion that the feasibility and sustainability of these courses need to be discussed in detail.

* After the elaborate discussions, it has been resolved to keep the proposal at abeyance for sometime, until the situation becomes conducive.

B. Items for Consideration

40.6 To consider and approve the minutes of the Board of Studies in the following programmes

1. Under Graduate Programme

A. Bio Medical Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Bio Medical Engineering for **B.Tech. Bio Medical Engineering** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, presented the recommendations of the 8th meeting of the Board of Studies conducted on July 21, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix BIOMED

S. Selvaraj

Prof. S. Selvarajan
Vice-Chancellor

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Approved by University Council on 8/11/2022 No. 1983

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, moved the recommendations of the Board of Studies of B.Tech. Bio Medical Engineering to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

Dr. R. Jagan Raj, Associate Professor & Head, Department of Aeronautical Engineering, seconded it.

The motion was carried

B. Civil Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Civil Engineering for **B.Tech. Civil Engineering** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, presented the recommendations of the Board of Studies meeting conducted on September 17, 2022.

The Minutes of the BoS meeting
can be accessed [here](#)



Appendix CIVIL

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, moved the recommendations of the Board of Studies of B.Tech. Civil Engineering to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

Dr. Amala Justus Selvam, Professor & Head, Department of Automobile Engineering, seconded it.

The motion was carried

C. Electronics and Communication Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Electronics and Communication Engineering for **B.Tech. Electronics and Communication Engineering** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, presented the recommendations of the Board of Studies meeting conducted on September 24, 2022.

The Minutes of the BoS meeting
can be accessed [here](#)



Appendix ECE

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, moved the recommendations of the Board of Studies of B.Tech. Electronics and Communication Engineering to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

S. Selim
Prof. S. Selvarajan
Vice Chancellor

- * **Mr.Ramakrishna** - External member, suggested to include ARM Processor as course content and experiment in course curriculum and syllabus.
- * He also suggested inclusion of the following contents in the course syllabus.
 - * High Speed Network
 - * Ethernet communication protocol
 - * GPRS, 4G, 5G and etc.,

Dr.Manoj.V.R, Associate Professor & Head, Department of Bio Technology, seconded it.

The motion was carried.

D. Information Technology

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Information Technology for **B.Tech. Information Technology** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr.C.Mahesh, Professor & Head, Department of Information Technology, presented the recommendations of the Board of Studies meeting conducted on September 23, 2022.

The Minutes of the BoS meeting can be accessed [here](#)



Appendix IT

Dr.C.Mahesh, Professor & Head, Department of Information Technology, moved the recommendations of the Board of Studies of B.Tech. Information Technology to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

Dr.P.Chandrasekar, Professor & Head, Department of Electrical & Electronics Engineering, seconded it.

The motion was carried

2. Post Graduate (PG) Programmes

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** and **Masters in Business Administration - I.E.V** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

a) Masters in Business Administration(M.B.A)

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, presented the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** presented the recommendations of the Board of Studies meeting conducted on August 13, 2022.

The Minutes of the BoS meeting can be accessed [here](#)



Appendix MBA

b) Masters in Business Administration(M.B.A) - I.E.V

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, presented the recommendations of the Board of Studies of School of Management for **Masters in Business Administration - I.E.V** presented the recommendations of the Board of Studies meeting conducted on August 13, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix MBA - I.E.V

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, moved the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** and **Masters in Business Administration - I.E.V** to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

- * **Mr.Ramakrishna** - External member, suggested to include the course contents, which is based on the "**Industry 4.0**" and also it has to cover the all relevant area's accordingly.
- * **Dean - MBA** conveyed his willingness to incorporate all the suggestions made by the external expert appropriately.

Dr. E. Suresh Paul, Professor & Dean - School of Media Technology & Communication, seconded it.

The motion was carried

40.7 To consider and approve the minutes of 23rd meeting of the Research Board.

The Vice Chancellor, placed before the Academic Council to consider and approve the minutes of 23rd meeting of the Research Board.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, presented the minutes of 23rd meeting of the Research Board.

*minutes of 23rd meeting of the
Research Board can be accessed*

[here](#)



Appendix Minutes

Dr. S. Koteeswaran, Professor & Dean - Research Studies, moved that "the result analysis of the semester end examination held during Summer Semester of the Academic Year 2021-22", be ratified.

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, seconded it.

The motion was carried

S. Selvam

*Prof. S. Sathyanandan
Vice Chancellor*

Vel Tech
Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

D. Items for Ratification

40.8 To ratify the admissions of candidates to Doctoral(Ph.D.) level programmes in Engineering and Technology/ Science / Law / Management / Humanities /Arts for Academic Year 2021-22.

The Vice Chancellor, placed before the Academic Council to ratify the admissions of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science /Law / Management/ Humanities / Arts for Academic Year 2021-22.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, presented the admissions of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science /Law / Management/ Humanities / Arts for Academic Year 2021-22.

1. Summary of Ph.D. National Admission AY 2021-22 (Winter Session)

Table 2: National Admission AY 2021-22 (Winter Session)

S.No	DEP'T	Research Supervisor Vacancy Positions	Applied	Short-listed	Eligible for Entrance Exam	Selected in Inter-view	FT	PT - INT	PT - EXT	Total
1	AERO	1	2	2	1	1	0	0	1	1
2	AUTO	17	1	1	1	1	0	0	1	1
3	CIVIL	9	5	5	5	2	1	0	1	2
4	MECH	147	14	12	12	5	1	0	3	4
5	IT	1	1	1	1	1	0	1	0	1
6	CSE	71	35	32	29	26	1	10	9	20
7	ECE	116	20	20	20	14	2	3	7	12
8	EEE	15	6	6	6	5	0	3	1	4
9	BIO TECH	21	4	4	4	4	2	1	1	4
10	BIO MEDICAL	17	2	2	1	1	0	0	0	0
11	ENGLISH	8	4	3	2	1	0	0	0	0
12	MATHS	65	11	11	5	4	2	1	0	3
13	PHYSICS	49	4	3	0	3	0	1	2	3
14	CHEM	38	4	4	3	1	0	1	0	1
15	LAW	6	13	12	12	6	0	4	2	6
16	MBA	0	2	0	0	0	0	0	0	0
TOTAL		581	128	118	102	75	9	25	28	62

2. Summary of Ph.D. International Admission AY 2021-22 (Winter Session)

S. Selvaraj

Prof. S. Selvaraj
Vice-Chancellor



Table 3: International Admission AY 2021-22 (Winter Session)

S.No	Dept's	Research Supervisor Vacancy Positions	App-plied	Short-listed	Eligible	Selected	Full Time	Country
1	AERO	1	0	0	0	0	0	-
2	AUTO	17	0	0	0	0	0	-
3	CIVIL	9	1	1	1	1	1	Syria - 1
4	MECH	147	1	1	1	1	0	-
5	IT	1	0	0	0	0	0	-
6	CSE	71	3	2	2	0	0	-
7	ECE	116	0	0	0	0	0	-
8	EEE	15	1	1	1	1	0	-
9	BIO TECH	21	3	2	2	0	0	-
10	BIO MED	17	0	0	0	0	0	-
11	ENG	8	1	1	1	0	0	-
12	MATHS	65	1	1	1	0	0	-
13	PHYSICS	49	0	0	0	0	0	-
14	CHEM	38	0	0	0	0	0	-
15	LAW	6	0	0	0	0	0	-
16	MBA	0	9	0	0	0	0	-
TOTAL		581	20	9	9	3	1	Syria-1

Dr.S.Koteeswaran, Professor & Dean - Research Studies, moved that "the Admissions of Ph.D. Students during the Winter semester of Academic year 2021-22", be ratified.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, seconded it.

The motion was carried.

40.9 To ratify the admissions under Institution Transfer category for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the list of students admitted through "Institution Transfer category" in Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Institution Transfer category in Summer Semester of the Academic Year 2022-23.

S. Selvam

Prof. S. Selvam
Vice-Chancellor

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology

Table 4: Institute Transfer Student List

S.No	VTU NO	Name of the Student	Department	Migration From
1	VTU 24000	ATTLA PENCHALA REDDY	Electronics and Communication Engineering	R.M.D Engineering College, Chennai.
2	VTU 24097	KEERTHIVASAN E	Computer Science and Engineering	PSG Institute of advanced Studies, Coimbatore.

Dr.E. Kannan, Professor & Registrar, moved that "the list of students admitted through Institution Transfer category in Summer Semester of the Academic Year 2022-23", be ratified.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, seconded it.

The motion was carried

40.10 To ratify the admissions under Lateral Entry category for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the list of students admitted under Lateral Entry category for Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Lateral Entry category in the Summer Semester of the Academic Year 2022-23 as on September 26, 2022.

List of Lateral Entry students can be accessed here



**Appendix Lateral Entry
Appendix Students Name
list**

Table 5: Statistics of Lateral Entry students as on September 26, 2022

S.No	Name of the Programme	Admitted Count
1	B.TECH - ARTIFICIAL INTELLIGENCE and MACHINE LEARNING	5
2	B.TECH - ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE	4
3	B.TECH - AERONAUTICAL ENGINEERING	2
4	B.TECH - AERONAUTICAL ENGINEERING WITH SPECIALIZATION IN AUTONOMOUS DRONE TECHNOLOGY	1
5	B.TECH - CIVIL ENGINEERING	6
6	B.TECH - COMPUTER SCIENCE and DESIGN	2
7	B.TECH - COMPUTER SCIENCE and ENGINEERING	29
8	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE	4

S. Selvam
Prof. & Chancellor
Vice-Chancellor

9	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	4
10	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	7
11	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY	4
12	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN DATA SCIENCE	1
13	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN IOT AND CYBER SECURITY INCLUDING BLOCK CHAIN TECHNOLOGY	2
14	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING	7
15	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS	8
16	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING	27
17	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	2
18	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	2
19	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY	1
20	B.TECH - INFORMATION TECHNOLOGY	5
21	B.TECH - MECHANICAL ENGINEERING	20
22	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS	11
23	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN AUTOMATION AND ROBOTICS	1
24	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN AUTOMOBILE ENGINEERING	1
25	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN MECHATRONICS	1
	Total	157

Dr.E. Kannan, Professor & Registrar, moved that "the list of students admitted through Lateral Entry category in Summer Semester of the Academic Year 2022-23 as on September 26, 2022", be ratified.

Dr. M. Sivakumar, Professor & Dean, Freshman Engineering, seconded it.

The motion was carried.

40.11 To ratify the admission under Migration from one Programme to another Programme in respect of the Under Graduate (UG) for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the list of students admitted through "migrated from one programme to another programme category" in Summer Semester of the Academic Year 2022-23.

P.S. Selvam
 Prof. & Registrar
 Vice-Chancellor

Dr.E. Kannan, Professor & Registrar, presented the list of students admitted through migrated from one programme to another programme category in Summer Semester of the Academic Year 2022-23.

list of migrated students can be accessed



Appendix Migration

Table 6: Statistics of Migration

S.No	Name of the Migration	No. of Students
1	Migration of one Programme to other Programme	16
2	Migration of Specialization within the Programme	45

Dr.E. Kannan, Professor & Registrar, moved to resolve "that the list of students admitted through migrated from one programme to another programme category (section 12.2 & 12.3 in Regulations VTR UGE 2021) in Summer Semester of the Academic Year 2022-23", be ratified.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

40.12 To ratify the admissions under Readmission category for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the admissions under Readmission category for Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Readmission category in Summer Semester of the Academic Year 2022-23.

Table 7: Students admitted through Readmission in Summer Semester AY 2022-23

S. No.	Batch	Sem.	ID No.	Name	Degree & Branch
1	2016-17	V Sem	VTA131	S. SARAN KUMAR	B.Com.
2	2019-20	IV Sem	VTP2622	CHIKKU R PULIKAN	M.Tech. Industrial Safety and Engineering
3	2019-20	V Sem	VTA573	R.D. MANIVEL	BA LL. B (Hons)
4	2019-20	VII Sem.	VTU15126	YENUGULA MANI KUMAR	B.Tech. Electronics and Communication Engineering
5	2019-20	VII Sem.	VTU15106	SRINIDHI S	B.Tech. Information Technology
6	2019-20	VII sem.	VTU15063	K. RAMNADH KRISHNA	B.Tech. Aeronautical Engineering
7	2019-20	VII sem.	VTU15944	MALLARAPU RAJESH	B.Tech. Electronics and Communication Engineering

8	2020-21	III Sem.	VTU12585	MADASRIHARI	B.Tech. Electronics and Communication Engineering
9	2020-21	III Sem.	VTU17745	JOGU SRINATH REDDY	B.Tech. Mechanical Engineering
10	2020-21	III Sem.	VTA626	P. MOHANAPRIYA	BA LL. B (Hons)
11	2020-21	III Sem.	VTA889	AJAY T	BA LL. B (Hons)
12	2020-21	IV Sem	VTP2839	REVENTH KRISHNA J	M.Tech. Industrial Safety and Engineering
13	2020-21	IV Sem	VTP2594	K. DHINAGARAN	M.Tech. Industrial Safety and Engineering
14	2020-21	V sem.	VTU11998	S BALAJI	B.Tech. Computer Science and Engineering
15	2021-22	II Sem.	VTU19483	ALLADA HEMANTH	B.Tech. Electronics and Communication Engineering
16	2021-22	III Sem.	VTU21005	ALLA HARSHA VARDHAN	B.Tech. Electronics and Communication Engineering
17	2021-22	III sem.	VTU21256	MANNERU SUDHARSHAN	B.Tech. Mechanical Engineering
18	2021-22	III Sem.	VTU20316	P. VENKATE SWARLU	B.Tech. Computer Science and Engineering
19	2021-22	III Sem.	VTP3324	S.SIDDHARTHAN	M.Tech. Industrial Safety and Engineering

Dr.E. Kannan, Professor & Registrar, moved to resolve that "the list of students admitted through Readmission category for Summer Semester of the Academic Year 2022-23", be ratified.

Dr.N. Lenin, Professor & Head, Department of Mechanical Engineering, seconded it.

The motion was carried

40.13 To ratify the number of students admitted for various programme for the Academic Year 22-23.

The Chair, placed before the Academic Council to ratify the number of students admitted for various programme for the Academic Year 22-23.

Dr.E. Kannan, Professor & Registrar, presented the number of students admitted for various programme for the Academic Year 22-23.

Admitted Students count for AY 2022-23

can be accessed here



Appendix Admitted Students count for AY 2022-23

Dr.E. Kannan, Professor & Registrar, moved that "the number of students admitted for various programme for the Academic Year 22-23", be ratified.

S. Selim

Some of the points were discussed on the decrease in the number of students for non-circuit branches:

- * To improve the student intake in Non-circuit branch through periodical advertisement.
- * To create awareness among the students regarding the benefit of offering non-circuit branches, which may help them in long run.
- * To encourage student to get them placed in medium scale companies. Even their initial salary package is minimal, the scope for learning fundamentals concepts is very high.
- * Students from non-circuit branch may also be considered to undergo rigorous training. So as to enable them to be selected in software companies and to be adopted themselves to be success in their carrier.

Dr.R.S. Valarmathi, Professor & Dean - Quality Assurance,seconded it.

The motion was carried

40.14 To ratify the examination results of Semester End Examinations held during the Winter Semester of Academic Year 2021-22.

The Chair, placed before the Academic Council to record the result analysis of the Semester end examination held during Winter Semester of the Academic Year 2021-22.

Dr. R. Sivaraman, Controller of Examinations, presented the UG / PG Programmes result analysis of the courses offered in Winter Semester of AY 2021-22.

result analysis of the Winter Semester of AY 2021-22 can be accessed [here](#)



Appendix Result Analysis

Table 8: B.TECH. - Total No. of courses for which the exams are conducted

Course	AERO	AUTO	CIVIL	MECH	EEE	ECE	CSE	IT	BIO TECH	BIO MED
Foundation	27									
Programme Core	13	10	19	40	14	24	80	17	13	10
Programme Elective	10	8	9	26	3	39	35	7	4	5
Allied Elective	5	4	7	6	10	9	15	9	5	2
Institute Elective	24	23	29	35	28	42	71	29	15	10

S. Sahithi

Table 8: B.TECH. - Total No. of courses for which the exams are conducted

Course	AERO	AUTO	CIVIL	MECH	EEE	ECE	CSE	IT	BIO TECH	BIO MED
Total	52	45	64	107	55	114	201	62	37	27
	791									

Dr. R. Sivaraman, Controller of Examinations, moved that "the result analysis of the semester end examination held during Winter Semester of the Academic Year 2020-21", be ratified.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, seconded it.

The motion was carried

40.15 To ratify the Academic Calendar of UG & PG programmes for the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the Academic Calendar for the Academic Year 2022-23 for Under-graduate (UG) and Post-graduate (PG) level programmes.

Dr. Carmel Mary Belinda M.J., Professor & Dean Academics(i/c), presented the Academic Calendars for the Academic Year 2022-23 for Under-graduate (UG) and Post-graduate (PG) level programmes.

The Academic Calendar for AY 2022-23 can be accessed [here](#)



Appendix Academic calendar

Dr. Carmel Mary Belinda M.J., Professor & Dean Academics(i/c), moved that "the Academic Calendar for the Academic Year 2022-23 for Under-graduate (UG) and Post-graduate (PG) level programmes", be ratified.

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, seconded it.

The motion was carried

E. Items for Reporting

40.16 To report the results of the Ph.D. viva voce conducted since last Academic Council held on May 06, 2022.

The Chair, placed before the Academic Council to ratify the results of the Ph.D. viva voce conducted since last Academic Council held on May 06, 2022.

Dr. R. Sivaraman, Controller of Examinations, presented the results of the Ph.D. viva voce conducted since last Academic Council held on May 06, 2022.

Prof. S. Salivahanan
Vice-Chancellor

Table 9: Ph.D. viva-voce completed candidate name list

S.No	Dept	Name	Viva-voce Date	Supervisor Name	Title
1	ECE	R Bharath Kumar	30.05.2022	Dr. P. Suresh	Performance Analysis of Various Classification Methods using Artificial Intelligence for Anesthesia Dosage
2	CSE	D. Raja-lakshmi	10.06.2022	Dr. K.Meena/ Dr. N.Raja-lakshmi	A Secured Intrusion Detection for Identifying Malicious Nodes in MANET using Hybrid Fuzzy based Protocol
3	CSE	L. Venkata Ramesh	11.06.2022	Dr. C.R. Bharathi	Reducing Packet Dropping Attacks in MANETs using Auditor and One hop Approach with Active Watchdog Technique
4	MECH	V. Thiruvengadam	13.06.2022	Dr. Ankur Bansod	Development of Silver Nano Particles Infiltrated PLA Nano Composite Films for Food Packaging
5	MATHS	K.A.Venka-tesan	13.06.2022	Dr.T.Guna-sekar	Studies on Existence of Solutions for Nonlinear Impulsive Neutral Functional Integrodifferential Equations with Delays in Banach Spaces
6	AERO	S. Kevin Bennett	17.06.2022	Dr. R. Naren Shankar	Investigation of Mixing Characteristics and Jet Noise Reduction in Subsonic Co-flowing Jets
7	ECE	Prasanna Ram	27.06.2022	Dr. N.M.Masoodhu Banu	Graphene based Antennas for Wireless Applications
8	MECH	V. Ramesh	13.07.2022	Dr. Anand P	Development and Evaluation of Basalt and Kevlar Fiber Reinforced Hybrid Polymer Composite
9	MECH	Jathar Laxmikant Dattatray	18.07.2022	Dr. S. Ganesan	Experimental Investigation and Performance Analysis of Concave Type Stepped Solar Still To Enhance the Productivity
10	CSE	Uma S	30.07.2022	Dr. Carmel Mary Belinda M.J.	Power Efficient Data Transmission from a Remote Operated Unmanned Vehicle to the Server through LTE with the Coexistence of BLE Relaying
11	CSE	A. Geetha	03.08.2022	Dr. N.Gomathi	Classification and Optimization of Brain Tumor MRI using Deep Belief Networks and Enhanced Optimization Techniques
12	ECE	Hushein R	10.08.2022	Dr. C.R. Bharathi	Experimental Investigations on Energy Harvesting Performance Analysis of 3D Printed Graphene

S. Sathish

Table 9: Ph.D. viva-voce completed candidate name list

S.No	Dept	Name	Viva-voce Date	Supervisor Name	Title
13	AERO	V.Kirubakaran	25.08.2022	Dr. R. Naren Shankar	Prediction of Lean Blowout Limit on CAN-TYPE Swirl Stabilised Micro Gas Turbine Combustor
14	CSE	M. Thanjai vadivel	05.09.2022	Dr. R. Suguna	Leaf Disease Detection using Fast and Enhanced Convolutional Neural Networks
15	ECE	P. Sharmila	06.09.2022	Dr. Selwin Mich Priyadharson	Data Gathering Protocols in Short-Range Wireless Networks for Enhanced Energy Efficiency and Secure Routing
16	CSE	S. Durai	07.09.2022	Dr. C. Mahesh	Vision based Method on Varietal Identification and Germination Prediction for Rice Seed
17	MECH	N. Pugazhenthii	08.09.2022	Dr. Anand P	Investigation on Hybrid Medium Density Fiberboard made of Coir and Basalt Fiber using Thermoset Resins
18	MECH	Senthil V	09.09.2022	Dr. E. Bala Subramanian	Experimental Investigation on Examining Hardness and Corrosion Characteristics of Friction STIR Processed Aluminium based Metal Matrix Composites
19	CSE	K. Jayanthi	17.09.2022	Dr. C. Mahesh	Deep Learning for Earlier Prediction of Pediatric Cardiomyopathy Disease from Gene Micro Array Data

Dr. R. Sivaraman, Controller of Examinations, moved that "the results of the Ph. D. viva voce conducted since last Academic Council held on May 06, 2022", be ratified.

Dr.C.Mahesh, Professor & Head, Department of Information Technology, seconded it.

The motion was carried

40.17 To report the approved intake of students for the Academic Year 2022-23 as per the EoA of AICTE.

The Chair, placed before the Academic Council to report the approved intake of students for the Academic Year 2022-23 as per the AICTE EoA.

S. Selim
 Prof. S. Selim
 Vice Chancellor



Dr.E. Kannan, Professor & Registrar, presented the report of the approved intake of students for the Academic Year 2022-23 as per the AICTE EoA.

AICTE EoA approval for AY 2022-23 can be accessed [here](#)



Appendix "AICTE EoA Approval"

Dr.E.Kannan, Professor & Registrar, moved that "the approved intake of students for the Academic Year 2022-23 as per the AICTE EoA", be reported.

Dr. Irudayaraj. S, Professor & Dean - School of Mechanical and Construction, seconded it.

The motion was carried

40.18 To record the progression and achievements of the following Schools and divisions:

The Chair, placed before the Academic Council to report the progression and achievements of following schools and divisions:

a) School of Electrical and Communication.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, presented the Progression of the School of Electrical and Communication and their academic achievements.

progression and academic achievements of the SoEC can be

accessed [here](#)



Appendix "Presentation of SoEC"

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, moved that "the progression and academic achievements of the School of Electrical and Communication", be recorded.

Dr.G.Sasikala, Professor, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

b) School of Media Technology.

S. Sathish

Prof. S. Sathish
Vice-Chancellor

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Approved by Director (Reg.) on 12/10/2022

Dr. E.Suresh Paul, Professor & Dean - School of Media Technology & Communication, presented the Progression of School of Media Technology and Communication and their academic achievements.

Progression of the School of Media Technology and Communication can be accessed [here](#)

Dr. E.Suresh Paul, Professor & Dean - School of Media Technology & Communication, presented the Progression of School of Media Technology and Communication and their academic achievements, be recorded".

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, seconded it.

The motion was carried

c) Office of Industry relations.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, presented the Progression of Office of Industry relations and their academic achievements.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, moved the "Progression of Office of Industry relations and their academic achievements", be recorded.

Dr. V. Srinivasa Rao, Professor & Dean, School of Computing, Computer Science & Engineering, seconded it.

The motion was carried.

F. Closing

40.19 Anyother items with the permission of the Chairperson

40.20 To decide the date of holding the next meeting of the Academic Council.

41st Regular Meeting of the Academic Council is tentatively scheduled on last week of January, 2023.

40.21 Vote of Thanks.

Dr. E. Kannan, Professor & Registrar, expressed his thanks to all the members of the Academic Council for their presence and valuable contributions.

40.22 Adjournment

The meeting was adjourned at 1 PM.


Prof. S. Sathishan
Vice Chancellor


Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)



**FORTIETH MEETING
OF
THE ACADEMIC COUNCIL**
Saturday, October 08, 2022

MINUTES

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MINUTES OF THE 40th MEETING OF THE ACADEMIC COUNCIL

Friday, October 8, 2022, at
10.30 a.m.

The Vice Chancellor welcomed all the members along with two new external members and highlighted the achievements of the Institution deemed to be university.

A. Opening

40.1 Call to Order and Approval of Agenda of the 40th meeting of the Academic Council.

The Chairperson called to order and placed the agenda for confirmation which was circulated to members by e-mail.

The Council confirmed the agenda.

40.2 Confirmation of the minutes of 39th meeting of the Academic Council held on Friday, May 06, 2022.

The minutes of the 39th meeting of the Academic Council held on May 06, 2022 were circulated to the members.

The draft minutes of the 39th meeting of the Academic Council can be accessed [here](#)



Appendix A

The minutes were confirmed.

40.3 To review the Action Taken Report on the minutes of the 39th meeting of the Academic Council held on May 06, 2022.

The Vice Chancellor, placed before the Academic Council to consider the Action Taken Report in respect of the 39th meeting of the Academic Council as described in Table 1.

Table 1: Action Taken Report in respect of 39th meeting of the Academic Council held on May 06, 2022.

S.No	Decision Taken	Action Taken Report
1	Item No 39.05 - Page 02 To consider and approve the minutes of Board of Studies	Text book and Reference book included with proper format.

The Council approved the Action Taken Report.

40.4 To record leave of absence of the members.

The following members expressed their inability to attend the meeting.

- * **Dr. Shankar Venugopal**
Vice President, Technology Innovation & KM,
Dean – Mahindra Technical Academy Mahindra World City.
- * **Prof. Dr. Krishnan Baskar,**
D.Sc. (KTH-Swedan), FRSC (London),
Director, Indian Institute of Technology-Senapathi.
- * **Dr. A.Subrahmanyam,**
Dean (SOL), Professor, Dept of Law,
Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.
- * **Dr. S.Prabakaran,**
Chief Librarian,
Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.
- * **Dr. N.Gomathi,**
Professor, Dept. of Computer Science and Engineering,
Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.
- * **Dr.CH.Hazarathaiah Yadav,**
Head-Chemistry, Professor, Dept of Chemistry
Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.

The list of members attended the 40th meeting of the Academic Council can be accessed [here](#)



Appendix Attendance

The Chair has noted their leave of absence.

B. Items for Discussion

40.5 To discuss on the introduction of PG Diploma courses and certification courses by Vel Tech TBI in collaboration with Industry Partners.

The Vice Chancellor, placed before the Academic Council to discuss and approve the PG Diploma programmes to be offered for the Academic Year 2022-23.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, presented the introduction of PG Diploma courses and certification courses by Vel Tech TBI in collaboration with Industry Partners.

Boston IT Solutions

1. PG Diploma in Data Science and Applied Artificial Intelligence (6 months/200 hours)
2. PG Diploma in Big Data Engineering (6 months/200 hours).

Certification programs (15 Hours)

1. Python for Data Science (15 Hours)
2. Data Science with SQL (15 Hours)
3. Data Science with Excel (15 Hours)
4. Introduction to AI (15 Hours)

* A few members were of the opinion that the feasibility and sustainability of these courses need to be discussed in detail.

* After the elaborate discussions, it has been resolved to keep the proposal at abeyance for sometime, until the situation becomes conducive.

B. Items for Consideration

40.6 To consider and approve the minutes of the Board of Studies in the following programmes

1. Under Graduate Programme

A. Bio Medical Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Bio Medical Engineering for **B.Tech. Bio Medical Engineering** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, presented the recommendations of the 8th meeting of the Board of Studies conducted on July 21, 2022.

The Minutes of the BoS meeting can be accessed [here](#)



Appendix BIOMED

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, moved the recommendations of the Board of Studies of B.Tech. Bio Medical Engineering to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

Dr. R. Jagan Raj, Associate Professor & Head, Department of Aeronautical Engineering, seconded it.

The motion was carried

B. Civil Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Civil Engineering for **B.Tech. Civil Engineering** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, presented the recommendations of the Board of Studies meeting conducted on September 17, 2022.

The Minutes of the BoS meeting
can be accessed [here](#)



Appendix CIVIL

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, moved the recommendations of the Board of Studies of B.Tech. Civil Engineering to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

Dr. Amala Justus Selvam, Professor & Head, Department of Automobile Engineering, seconded it.

The motion was carried

C. Electronics and Communication Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Electronics and Communication Engineering for **B.Tech. Electronics and Communication Engineering** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, presented the recommendations of the Board of Studies meeting conducted on September 24, 2022.

The Minutes of the BoS meeting
can be accessed [here](#)



Appendix ECE

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, moved the recommendations of the Board of Studies of B.Tech. Electronics and Communication Engineering to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

- * **Mr.Ramakrishna** - External member, suggested to include ARM Processor as course content and experiment in course curriculum and syllabus.
- * He also suggested inclusion of the following contents in the course syllabus.
 - * High Speed Network
 - * Ethernet communication protocol
 - * GPRS, 4G, 5G and etc.,

Dr.Manoj.V.R, Associate Professor & Head, Department of Bio Technology, seconded it.

The motion was carried.

D. Information Technology

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Information Technology for **B.Tech. Information Technology** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

Dr.C.Mahesh, Professor & Head, Department of Information Technology, presented the recommendations of the Board of Studies meeting conducted on September 23, 2022.

*The Minutes of the BoS meeting
can be accessed [here](#)*



Appendix IT

Dr.C.Mahesh, Professor & Head, Department of Information Technology, moved the recommendations of the Board of Studies of B.Tech. Information Technology to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

Dr.P.Chandrasekar, Professor & Head, Department of Electrical & Electronics Engineering, seconded it.

The motion was carried

2. Post Graduate (PG) Programmes

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** and **Masters in Business Administration - I.E.V** to be implemented with effect from the Summer Semester of the Academic Year 2022-23.

a) Masters in Business Administration(M.B.A)

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, presented the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** presented the recommendations of the Board of Studies meeting conducted on August 13, 2022.

*The Minutes of the BoS meeting
can be accessed [here](#)*



Appendix MBA

b) Masters in Business Administration(M.B.A) - I.E.V

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, presented the recommendations of the Board of Studies of School of Management for **Masters in Business Administration - I.E.V** presented the recommendations of the Board of Studies meeting conducted on August 13, 2022.

The Minutes of the BoS meeting
can be accessed [here](#)



Appendix MBA - I.E.V

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, moved the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** and **Masters in Business Administration - I.E.V** to be implemented with effect from the Summer Semester of the Academic Year 2022-23, be approved.

- * **Mr.Ramakrishna** - External member, suggested to include the course contents, which is based on the "**Industry 4.0**" and also it has to cover the all relevant area's accordingly.
- * **Dean - MBA** conveyed his willingness to incorporate all the suggestions made by the external expert appropriately.

Dr. E. Suresh Paul, Professor & Dean - School of Media Technology & Communication, seconded it.

The motion was carried

40.7 To consider and approve the minutes of 23rd meeting of the Research Board.

The Vice Chancellor, placed before the Academic Council to consider and approve the minutes of 23rd meeting of the Research Board.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, presented the minutes of 23rd meeting of the Research Board.

minutes of 23rd meeting of the
Research Board can be accessed



Appendix Minutes

Dr. S. Koteeswaran, Professor & Dean - Research Studies, moved that "the result analysis of the semester end examination held during Summer Semester of the Academic Year 2021-22", be ratified.

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, seconded it.

The motion was carried

D. Items for Ratification**40.8 To ratify the admissions of candidates to Doctoral(Ph.D.) level programmes in Engineering and Technology/ Science / Law / Management / Humanities /Arts for Academic Year 2021-22.**

The Vice Chancellor, placed before the Academic Council to ratify the admissions of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science /Law / Management/ Humanities / Arts for Academic Year 2021-22.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, presented the admissions of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science /Law / Management/ Humanities / Arts for Academic Year 2021-22.

1. Summary of Ph.D. National Admission AY 2021-22 (Winter Session)

Table 2: National Admission AY 2021-22 (Winter Session)

S.No	DEP'T	Research Supervisor Vacancy Positions	Appl-ied	Short-listed	Eligible for Entrance Exam	Selected in Inter-view	FT	PT - INT	PT - EXT	Total
1	AERO	1	2	2	1	1	0	0	1	1
2	AUTO	17	1	1	1	1	0	0	1	1
3	CIVIL	9	5	5	5	2	1	0	1	2
4	MECH	147	14	12	12	5	1	0	3	4
5	IT	1	1	1	1	1	0	1	0	1
6	CSE	71	35	32	29	26	1	10	9	20
7	ECE	116	20	20	20	14	2	3	7	12
8	EEE	15	6	6	6	5	0	3	1	4
9	BIO TECH	21	4	4	4	4	2	1	1	4
10	BIO MEDICAL	17	2	2	1	1	0	0	0	0
11	ENGLISH	8	4	3	2	1	0	0	0	0
12	MATHS	65	11	11	5	4	2	1	0	3
13	PHYSICS	49	4	3	0	3	0	1	2	3
14	CHEM	38	4	4	3	1	0	1	0	1
15	LAW	6	13	12	12	6	0	4	2	6
16	MBA	0	2	0	0	0	0	0	0	0
TOTAL		581	128	118	102	75	9	25	28	62

2. Summary of Ph.D. International Admission AY 2021-22 (Winter Session)

Table 3: International Admission AY 2021-22 (Winter Session)

S.No	Dept's	Research Supervisor Vacancy Positions	App-plied	Short-listed	Eligible	Selected	Full Time	Country
1	AERO	1	0	0	0	0	0	-
2	AUTO	17	0	0	0	0	0	-
3	CIVIL	9	1	1	1	1	1	Syria - 1
4	MECH	147	1	1	1	1	0	-
5	IT	1	0	0	0	0	0	-
6	CSE	71	3	2	2	0	0	-
7	ECE	116	0	0	0	0	0	-
8	EEE	15	1	1	1	1	0	-
9	BIO TECH	21	3	2	2	0	0	-
10	BIO MED	17	0	0	0	0	0	-
11	ENG	8	1	1	1	0	0	-
12	MATHS	65	1	1	1	0	0	-
13	PHYSICS	49	0	0	0	0	0	-
14	CHEM	38	0	0	0	0	0	-
15	LAW	6	0	0	0	0	0	-
16	MBA	0	9	0	0	0	0	-
TOTAL		581	20	9	9	3	1	Syria-1

Dr.S.Koteeswaran, Professor & Dean - Research Studies, moved that "the Admissions of Ph.D. Students during the Winter semester of Academic year 2021-22", be ratified.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, seconded it.

The motion was carried.

40.9 To ratify the admissions under Institution Transfer category for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the list of students admitted through "Institution Transfer category" in Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Institution Transfer category in Summer Semester of the Academic Year 2022-23.

Table 4: Institute Transfer Student List

S.No	VTU NO	Name of the Student	Department	Migration From
1	VTU 24000	ATTLA PENCHALA REDDY	Electronics and Communication Engineering	R.M.D Engineering College, Chennai.
2	VTU 24097	KEERTHIVASAN E	Computer Science and Engineering	PSG Institute of advanced Studies, Coimbatore.

Dr.E. Kannan, Professor & Registrar, moved that "the list of students admitted through Institution Transfer category in Summer Semester of the Academic Year 2022-23", be ratified.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, seconded it.

The motion was carried

40.10 To ratify the admissions under Lateral Entry category for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the list of students admitted under Lateral Entry category for Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Lateral Entry category in the Summer Semester of the Academic Year 2022-23 as on September 26, 2022.

*list of Lateral Entry students can be
accessed [here](#)*



**Appendix Lateral Entry
Appendix Students Name
list**

Table 5: Statistics of Lateral Entry students as on September 26, 2022

S.No	Name of the Programme	Admitted Count
1	B.TECH - ARTIFICIAL INTELLIGENCE and MACHINE LEARNING	5
2	B.TECH - ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE	4
3	B.TECH - AERONAUTICAL ENGINEERING	2
4	B.TECH - AERONAUTICAL ENGINEERING WITH SPECIALIZATION IN AUTONOMOUS DRONE TECHNOLOGY	1
5	B.TECH - CIVIL ENGINEERING	6
6	B.TECH - COMPUTER SCIENCE and DESIGN	2
7	B.TECH - COMPUTER SCIENCE and ENGINEERING	29
8	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE	4

9	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	4
10	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	7
11	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY	4
12	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN DATA SCIENCE	1
13	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECILIZATION IN IOT AND CYBER SECURITY INCLUDING BLOCK CHAIN TECHNOLOGY	2
14	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING	7
15	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS	8
16	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING	27
17	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	2
18	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	2
19	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY	1
20	B.TECH - INFORMATION TECHNOLOGY	5
21	B.TECH - MECHANICAL ENGINEERING	20
22	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS	11
23	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN AUTOMATION AND ROBOTICS	1
24	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN AUTOMOBILE ENGINEERING	1
25	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN MECHATRONICS	1
Total		157

Dr.E. Kannan, Professor & Registrar, moved that "the list of students admitted through Lateral Entry category in Summer Semester of the Academic Year 2022-23 as on September 26, 2022", be ratified.

Dr. M. Sivakumar, Professor & Dean, Freshman Engineering, seconded it.

The motion was carried.

40.11 To ratify the admission under Migration from one Programme to another Programme in respect of the Under Graduate (UG) for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the list of students admitted through "migrated from one programme to another programme category" in Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented the list of students admitted through migrated from one programme to another programme category in Summer Semester of the Academic Year 2022-23.

list of migrated students can be accessed



Appendix Migration

Table 6: Statistics of Migration

S.No	Name of the Migration	No. of Students
1	Migration of one Programme to other Programme	16
2	Migration of Specialization within the Programme	45

Dr.E. Kannan, Professor & Registrar, moved to resolve "that the list of students admitted through migrated from one programme to another programme category (section 12.2 & 12.3 in Regulations VTR UGE 2021) in Summer Semester of the Academic Year 2022-23", be ratified.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

40.12 To ratify the admissions under Readmission category for Summer Semester of the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the admissions under Readmission category for Summer Semester of the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Readmission category in Summer Semester of the Academic Year 2022-23.

Table 7: Students admitted through Readmission in Summer Semester AY 2022-23

S. No.	Batch	Sem.	ID No.	Name	Degree & Branch
1	2016-17	V Sem	VTA131	S. SARAN KUMAR	B.Com.
2	2019-20	IV Sem	VTP2622	CHIKKU R PULIKAN	M.Tech. Industrial Safety and Engineering
3	2019-20	V Sem	VTA573	R.D. MANIVEL	BA LL. B (Hons)
4	2019-20	VII Sem.	VTU15126	YENUGULA MANI KUMAR	B.Tech. Electronics and Communication Engineering
5	2019-20	VII Sem.	VTU15106	SRINIDHI S	B.Tech. Information Technology
6	2019-20	VII sem.	VTU15063	K. RAMNADH KRISHNA	B.Tech. Aeronautical Engineering
7	2019-20	VII sem.	VTU15944	MALLARAPU RAJESH	B.Tech. Electronics and Communication Engineering

8	2020-21	III Sem.	VTU12585	MADASRIHARI	B.Tech. Electronics and Communication Engineering
9	2020-21	III Sem.	VTU17745	JOGU SRINATH REDDY	B.Tech. Mechanical Engineering
10	2020-21	III Sem.	VTA626	P. MOHANAPRIYA	BA LL. B (Hons)
11	2020-21	III Sem.	VTA889	AJAY T	BA LL. B (Hons)
12	2020-21	IV Sem	VTP2839	REVENTH KRISHNA J	M.Tech. Industrial Safety and Engineering
13	2020-21	IV Sem	VTP2594	K. DHINAGARAN	M.Tech. Industrial Safety and Engineering
14	2020-21	V sem.	VTU11998	S BALAJI	B.Tech. Computer Science and Engineering
15	2021-22	II Sem.	VTU19483	ALLADA HEMANTH	B.Tech. Electronics and Communication Engineering
16	2021-22	III Sem.	VTU21005	ALLA HARSHA VARDHAN	B.Tech. Electronics and Communication Engineering
17	2021-22	III sem.	VTU21256	MANNERU SUDHARSHAN	B.Tech. Mechanical Engineering
18	2021-22	III Sem.	VTU20316	P. VENKATE SWARLU	B.Tech. Computer Science and Engineering
19	2021-22	III Sem.	VTP3324	S.SIDDHARTHAN	M.Tech. Industrial Safety and Engineering

Dr.E. Kannan, Professor & Registrar, moved to resolve that "the list of students admitted through Readmission category for Summer Semester of the Academic Year 2022-23", be ratified.

Dr.N. Lenin, Professor & Head, Department of Mechanical Engineering, seconded it.

The motion was carried

40.13 To ratify the number of students admitted for various programme for the Academic Year 22-23.

The Chair, placed before the Academic Council to ratify the number of students admitted for various programme for the Academic Year 22-23.

Dr.E. Kannan, Professor & Registrar, presented the number of students admitted for various programme for the Academic Year 22-23.

Admitted Students count for AY 2022-23

can be accessed [here](#)



Appendix Admitted Students count for AY 2022-23

Dr.E. Kannan, Professor & Registrar, moved that "the number of students admitted for various programme for the Academic Year 22-23", be ratified.

Some of the points were discussed on the decrease in the number of students for non-circuit branches:

- * To improve the student intake in Non-circuit branch through periodical advertisement.
- * To create awareness among the students regarding the benefit of offering non-circuit branches, which may help them in long run.
- * To encourage student to get them placed in medium scale companies. Even their initial salary package is minimal, the scope for learning fundamentals concepts is very high.
- * Students from non-circuit branch may also be considered to undergo rigorous training. So as to enable them to be selected in software companies and to be adopted themselves to be success in their carrier.

Dr.R.S. Valarmathi, Professor & Dean - Quality Assurance,seconded it.

The motion was carried

40.14 To ratify the examination results of Semester End Examinations held during the Winter Semester of Academic Year 2021-22.

The Chair, placed before the Academic Council to record the result analysis of the Semester end examination held during Winter Semester of the Academic Year 2021-22.

Dr. R. Sivaraman, Controller of Examinations, presented the UG / PG Programmes result analysis of the courses offered in Winter Semester of AY 2021-22.

result analysis of the Winter Semester of AY 2021-22 can be accessed [here](#)



Appendix Result Analysis

Table 8: B.TECH. - Total No. of courses for which the exams are conducted

Course	AERO	AUTO	CIVIL	MECH	EEE	ECE	CSE	IT	BIO TECH	BIO MED
Foundation	27									
Programme Core	13	10	19	40	14	24	80	17	13	10
Programme Elective	10	8	9	26	3	39	35	7	4	5
Allied Elective	5	4	7	6	10	9	15	9	5	2
Institute Elective	24	23	29	35	28	42	71	29	15	10

Table 8: B.TECH. - Total No. of courses for which the exams are conducted

Course	AERO	AUTO	CIVIL	MECH	EEE	ECE	CSE	IT	BIO TECH	BIO MED
Total	52	45	64	107	55	114	201	62	37	27
	791									

Dr. R. Sivaraman, Controller of Examinations, moved that "the result analysis of the semester end examination held during Winter Semester of the Academic Year 2020-21", be ratified.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, seconded it.

The motion was carried

40.15 To ratify the Academic Calendar of UG & PG programmes for the Academic Year 2022-23.

The Chair, placed before the Academic Council to ratify the Academic Calendar for the Academic Year 2022-23 for Under-graduate (UG) and Post-graduate (PG) level programmes.

Dr. Carmel Mary Belinda M.J., Professor & Dean Academics(i/c), presented the Academic Calendars for the Academic Year 2022-23 for Under-graduate (UG) and Post-graduate (PG) level programmes.

The Academic Calendar for AY 2022-23 can be accessed [here](#)



Appendix Academic calendar

Dr. Carmel Mary Belinda M.J., Professor & Dean Academics(i/c), moved that "the Academic Calendar for the Academic Year 2022-23 for Under-graduate (UG) and Post-graduate (PG) level programmes", be ratified.

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, seconded it.

The motion was carried

E. Items for Reporting

40.16 To report the results of the Ph.D. viva voce conducted since last Academic Council held on May 06, 2022.

The Chair, placed before the Academic Council to ratify the results of the Ph.D. viva voce conducted since last Academic Council held on May 06, 2022.

Dr. R. Sivaraman, Controller of Examinations, presented the results of the Ph.D. viva voce conducted since last Academic Council held on May 06, 2022.

Table 9: Ph.D. viva-voce completed candidate name list

S.No	Dept	Name	Viva-voce Date	Supervisor Name	Title
1	ECE	R Bharath Kumar	30.05.2022	Dr. P. Suresh	Performance Analysis of Various Classification Methods using Artificial Intelligence for Anesthesia Dosage
2	CSE	D. Raja-lakshmi	10.06.2022	Dr. K.Meena/ Dr. N.Raja-lakshmi	A Secured Intrusion Detection for Identifying Malicious Nodes in MANET using Hybrid Fuzzy based Protocol
3	CSE	L. Venkata Ramesh	11.06.2022	Dr. C.R. Bharathi	Reducing Packet Dropping Attacks in MANETs using Auditor and One hop Approach with Active Watchdog Technique
4	MECH	V. Thiruvengadam	13.06.2022	Dr. Ankur Bansod	Development of Silver Nano Particles Infiltrated PLA Nano Composite Films for Food Packaging
5	MATHS	K.A.Venkatesan	13.06.2022	Dr.T.Gunasekar	Studies on Existence of Solutions for Nonlinear Impulsive Neutral Functional Integrodifferential Equations with Delays in Banach Spaces
6	AERO	S. Kevin Bennett	17.06.2022	Dr. R. Naren Shankar	Investigation of Mixing Characteristics and Jet Noise Reduction in Subsonic Co-flowing Jets
7	ECE	Prasanna Ram	27.06.2022	Dr. N.M.Masoodhu Banu	Graphene based Antennas for Wireless Applications
8	MECH	V. Ramesh	13.07.2022	Dr. Anand P	Development and Evaluation of Basalt and Kevlar Fiber Reinforced Hybrid Polymer Composite
9	MECH	Jathar Laxmikant Dattatray	18.07.2022	Dr. S. Ganesan	Experimental Investigation and Performance Analysis of Concave Type Stepped Solar Still To Enhance the Productivity
10	CSE	Uma S	30.07.2022	Dr. Carmel Mary Belinda M.J.	Power Efficient Data Transmission from a Remote Operated Unmanned Vehicle to the Server through LTE with the Coexistence of BLE Relaying
11	CSE	A. Geetha	03.08.2022	Dr. N.Gomathi	Classification and Optimization of Brain Tumor MRI using Deep Belief Networks and Enhanced Optimization Techniques
12	ECE	Hushein R	10.08.2022	Dr. C.R. Bharathi	Experimental Investigations on Energy Harvesting Performance Analysis of 3D Printed Graphene

Table 9: Ph.D. viva-voce completed candidate name list

S.No	Dept	Name	Viva-voce Date	Supervisor Name	Title
13	AERO	V.Kirubakaran	25.08.2022	Dr. R. Naren Shankar	Prediction of Lean Blowout Limit on CAN-TYPE Swirl Stabilised Micro Gas Turbine Combustor
14	CSE	M. Thanjai vadivel	05.09.2022	Dr. R. Suguna	Leaf Disease Detection using Fast and Enhanced Convolutional Neural Networks
15	ECE	P. Sharmila	06.09.2022	Dr. Selwin Mich Priyadharson	Data Gathering Protocols in Short-Range Wireless Networks for Enhanced Energy Efficiency and Secure Routing
16	CSE	S. Durai	07.09.2022	Dr. C. Mahesh	Vision based Method on Varietal Identification and Germination Prediction for Rice Seed
17	MECH	N. Pugazh-enthi	08.09.2022	Dr. Anand P	Investigation on Hybrid Medium Density Fiberboard made of Coir and Basalt Fiber using Thermoset Resins
18	MECH	Senthil V	09.09.2022	Dr. E. Bala Subramanian	Experimental Investigation on Examining Hardness and Corrosion Characteristics of Friction STIR Processed Aluminium based Metal Matrix Composites
19	CSE	K. Jayanthi	17.09.2022	Dr. C. Mahesh	Deep Learning for Earlier Prediction of Pediatric Cardiomyopathy Disease from Gene Micro Array Data

Dr. R. Sivaraman, Controller of Examinations, moved that "the results of the Ph. D. viva voce conducted since last Academic Council held on May 06, 2022", be ratified.

Dr.C.Mahesh, Professor & Head, Department of Information Technology, seconded it.

The motion was carried

40.17 To report the approved intake of students for the Academic Year 2022-23 as per the EoA of AICTE.

The Chair, placed before the Academic Council to report the approved intake of students for the Academic Year 2022-23 as per the AICTE EoA.

Dr.E. Kannan, Professor & Registrar, presented the report of the approved intake of students for the Academic Year 2022-23 as per the AICTE EoA.

*AICTE EoA approval for AY
2022-23 can be accessed [here](#)*



**Appendix "AICTE EoA
Approval"**

Dr.E.Kannan, Professor & Registrar, moved that "the approved intake of students for the Academic Year 2022-23 as per the AICTE EoA", be reported.

Dr. Irudayaraj. S, Professor & Dean - School of Mechanical and Construction, seconded it.

The motion was carried

40.18 To record the progression and achievements of the following Schools and divisions:

The Chair, placed before the Academic Council to report the progression and achievements of following schools and divisions:

a) School of Electrical and Communication.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, presented the Progression of the School of Electrical and Communication and their academic achievements.

*progression and academic
achievements of the SoEC can be*

accessed [here](#)



**Appendix
"Presentation of
SoEC"**

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, moved that "the progression and academic achievements of the School of Electrical and Communication", be recorded.

Dr.G.Sasikala, Professor, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

b) School of Media Technology.

Dr. E.Suresh Paul, Professor & Dean - School of Media Technology & Communication, presented the Progression of School of Media Technology and Communication and their academic achievements.

Progression of the School of Media Technology and Communication can be accessed [here](#)

Dr. E.Suresh Paul, Professor & Dean - School of Media Technology & Communication, presented the Progression of School of Media Technology and Communication and their academic achievements, be recorded".

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, seconded it.

The motion was carried

c) Office of Industry relations.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, presented the Progression of Office of Industry relations and their academic achievements.

Dr. P. Chandra Kumar, Professor & Dean - Industry Relations, moved the "Progression of Office of Industry relations and their academic achievements", be recorded.

Dr. V. Srinivasa Rao, Professor & Dean, School of Computing, Computer Science & Engineering, seconded it.

The motion was carried.

F. Closing

40.19 Anyother items with the permission of the Chairperson

40.20 To decide the date of holding the next meeting of the Academic Council.

41st Regular Meeting of the Academic Council is tentatively scheduled on last week of January, 2023.

40.21 Vote of Thanks.

Dr. E. Kannan, Professor & Registrar, expressed his thanks to all the members of the Academic Council for their presence and valuable contributions.

40.22 Adjournment

The meeting was adjourned at 1 PM.



Vel Tech

Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Est. u/s 3 of UGC Act, 1956)

**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**




S.No	Name	Position	Signature
1	Prof.S.Salivahanan Vice Chancellor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Chairperson	S. Salivan
2 ✓	Prof. R. Venkata Rao (Former Vice Chancellor, National Law School of Indian University, Bangalore) Chairperson, Vivekananda School of Law & Legal Studies & Vivekananda School of English Studies.	External Member	PRESENT
3 ✓	Prof. N. V. Ramana Rao Director, National Institute of Technology Warangal, Telangana -506004.	External Member	PRESENT
4 ✓	Dr. OR. Nanda gopan Director, DRDO Industry Academia Ramanujan Centre of Excellence (DIA-RCoE) IITM, Research Park, Chennai.	External Member	PRESENT
5	Dr. Shankar Venugopal Vice President, Technology Innovation & KM Dean - Mahindra Technical Academy Mahindra World City, Chengalpattu, TamilNadu.	External Member	ABSENT
6 ✓	Mr. Ramakrishna Chief Executive Officer and Managing Director, Effronics Systems Pvt. Ltd., Vijayawada	External Member	PRESENT



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ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE

S.No	Name	Position	Signature
7 ✓	Dr. K. Sankaranarayananasamy, Director, National Institute of Technology (NIT), Puducherry	External Member	PRESENT
8	Prof. Dr. Krishnan Baskar. D.Sc. (KTH-Sweden), FRSC(London). Director, Indian Institute of Technology- Senapati, Manipur Mantripukri, Imphal	External Member	ABSENT
9	Dr.Carmel Mary Belinda M J Dean (Academics i/c), Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
10	Dr.R.S.Valarmathi Dean (Quality Assurance), Professor, Dept of Electronics and Communication Engineering VelTech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member	
11	Dr. P. Chandrakumar Dean (Industry Relations), Professor, Dept of Mechanical Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member	



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**ATTENDANCE SHEET FOR 40-MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**

S.No	Name	Position	Signature
12	Dr.M.Sivakumar Dean (FME), Professor, Dept of Mechanical Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
13	Dr.P.Suresh Dean (International Relations), Professor, Dept of Electronics and Communication Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member	
14	Mr.P.Vijayaraman Dean -In charge (Campus to Corporate), Assistant Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member	
15	Dr.S.Irudayaraj Dean(SOMC), Professor, Dept of Mechanical Engineering Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology.	Ex-officio	
16	Dr.V.Jayasankar Dean(SOE), Professor, Dept of Electrical and Electronics Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	



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**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**



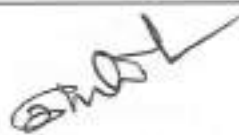


S.No	Name	Position	Signature
17	Dr.A.Subrahmanyam Dean(SOL), Professor, Dept of Law, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	ARCENT
18	Dr.V.Srinivasa Rao Dean, (i/c) & Head – Computer Science & Engineering, Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	
19	Dr.S. Koteeswaran Dean (Research), Professor, Dept of Computer Science and Engineering Vel Tech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology.	Internal Member	
20	Dr. M.S.R. Mariyappan, Dean (School of Management), Professor, Dept of MBA, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology	Internal Member	
21	Dr.E.Suresh Paul Dean - Media Technology & Communication, Professor, VelTech Rangarajan Dr. Sagunthala R& D Institute of Science and Technology.	Ex-officio	



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**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**




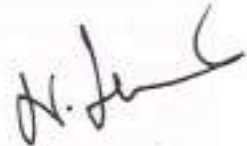
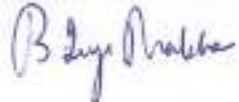
S.No	Name	Position	Signature
22	Dr.E.Balasubramanian DIND, Professor, Dept. of Mechanical Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
23	Dr. R. Sivaraman Controller of Examinations, VelTech Rangarajan Dr.Sagunthala R & D Institute of Science andTechnology.	Permanent Invitee	
24	Dr. R. Jaganraj Associate Professor, Head – Aeronautical Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
25	Dr.Amala Justus Selvam Head –Automobile Engineering, Professor, Dept of Automobile Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
26	Dr. A. Geetha Selvarani, Head – Civil Engineering, Professor Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member	



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**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**

S.No	Name	Position	Signature
27	Dr.P.Chandrasekar Head-Electrical & Electronics Engineering, Professor, Dept of Electrical & Electronics Engineering Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology.	Ex-officio	
28	Dr.P.Esther Rani, Head - Electronics & Communication Engineering, Professor, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai-62.	Ex-officio	
29	Dr.C.Mahesh Head-Information Technology, Professor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	
30	Dr. N. Lenin, Head - Mechanical Engineering, Professor, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology,	Ex-officio	
31	Dr.B.Jeya Prabha Professor, Head - Business Administration, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	



**ATTENDANCE SHEET FOR 40-MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**





S.No	Name	Position	Signature
32	Ms.J.Sri Devi Head – Commerce and Business Administration, Assistant Professor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	J.L.L.
33	Dr.M.L.Suresh Head –Mathematics, Professor, Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	M.L.Suresh
34	Dr. Senthil Kumar Head - Physics, Associate Professor, VelTech Rangarajan Dr.Sagunthala R& D Institute of Science and Technology.	Ex-officio	S.Kumar
35	Dr.CH.Hazarathaiyah Yadav Head-Chemistry, Professor, Vel Tech Rangarajan Dr. Sagunthala R &D Institute of Science and Technology.	Ex-officio	ABSENT
36	Dr. M.R.Bindu Head-English, Professor, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	M.R.B
37	Dr.N.M. MasoodhuBanu Head/c –Bio Medical, Professor Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Ex-officio	N.M. MasoodhuBanu



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**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**


S.No	Name	Position	Signature
38	Dr.V.R.Manoj Head i/c- BioTechnology, Professor Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science and Technology.	Ex-officio	
39	Dr.S.Samson Professor, Dept of Civil Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
40	Dr.N.Gomathi Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	ABSENT
41	Dr.Malarvizhi N Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
42	Dr.P.K.Dhal Professor, Dept.of Electrical and Electronics Engineering Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member Representing as Professor	



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**ATTENDANCE SHEET FOR 40-MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**

S.No	Name	Position	Signature
43	Dr. J.L.Mazher Iqbal Professor, Dept.of Electronics and Communication Engineering, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
44	Dr. V. Sundara pandian Professor, Dept.of Mathematics Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	<i>V.Sundara Pandian</i>
45	Dr. E. Chandrasekaran Professor, Dept.of Mathematics Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member Representing as Professor	<i>E.Chandrasekaran</i>
46	Dr. M. Kavitha Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	<i>M.Kavitha</i>
47	Dr.G.Sasikala Professor, Dept.of Electronics and Communication Engineering Vel Tech Rangarajan Dr. Sagunthala R & D Institute of Science andTechnology.	Internal Member Representing as Professor	<i>G.Sasikala</i>



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R&D Institute of Science and Technology
(Deemed to be University Ent. u/s 3 of UGC Act, 1956)

**ATTENDANCE SHEET FOR 40th MEETING OF
THE ACADEMIC COUNCIL ON 08.10.2022 AT 10.30 am
Through ONLINE MODE**

S.No	Name	Position	Signature
48	Dr.R.Kavitha Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
49	Dr.V.S.Hemakumar Professor, Dept.of Electronics and Communication Engineering Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Professor	
50	Dr.C.T.Dora Pravina Associate Professor, Dept.of Mathematics, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology.	Internal Member Representing as Associate Professor	
51	Dr. D.Kanagajothi Associate Professor, Dept.of Mathematics, VelTech Rangarajan Dr.Sagunthala R & D Institute of Science andTechnology.	Internal MemberRepr esenting asAssociate Professor	
52	Dr.S.Prabakaran Chief Librarian, VelTech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology.	Internal Member	ABSENT
53	Dr.E.Kannan Registrar, Professor, Dept.of Computer Science and Engineering Vel Tech Rangarajan Dr. Sagunthala R &D Institute of Science and Technology.	Secretary	



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**THIRTY NINTH MEETING
OF
THE ACADEMIC COUNCIL
Friday, May 06, 2022**

MINUTES

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39.4 To record leave of absence of the members.	2
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39.5 To consider and approve the minutes of the Board of Studies of the following discipline:	2
39.6 To discuss and approve the UG & PG programmes to be offered for the Academic Year 2022-23.	13
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39.7 To ratify the admissions under Re-Admission category for Winter Semester of the Academic Year 2021-22.	17
39.8 To ratify the admissions under Institution Transfer category for Winter Semester of the Academic Year 2021-22.	17
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D. Items for Reporting	20
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39.12 To report the results of the Ph.D. viva voce conducted since last Academic Council held on December 23, 2021.	22
39.13 To report the Strategic Plan 21-26 of this Institution.	23

39.14 To record the progression and achievements of the following Schools :	24
39.15 To report the activities of the office of Campus to corporate.	24
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MINUTES OF THE 39th MEETING OF THE ACADEMIC COUNCIL

Friday, May 06, 2022, at
10.30 a.m.

The Vice Chancellor welcomed all the members and highlighted the achievements of the Institution deemed to be university.

A. Opening

39.1 Call to Order and Approval of Agenda of the 39th meeting of the Academic Council.

The Chairperson called to order and placed the agenda for confirmation which was circulated to members by e-mail.

The Council confirmed the agenda.

39.2 Confirmation of the minutes of 38th meeting of the Academic Council held on Thursday, December 23, 2021.

The minutes of the 38th meeting of the Academic Council held on December 23, 2021 were circulated to the members.

The draft minutes of the 38th meeting of the Academic Council can be accessed [here](#)



Appendix A

The minutes were confirmed.

39.3 To review the Action Taken Report on the minutes of the 38th meeting of the Academic Council held on December 23, 2021.

The Vice Chancellor, placed before the Academic Council to consider the Action Taken Report in respect of the 38th meeting of the Academic Council as described in Table 1.

Table 1: Action Taken Report in respect of 38th meeting of the Academic Council held on December 23, 2021

S.No	Decision Taken	Action Taken Report
1	<u>Item No 38.05 - Page 02</u> To consider and approve the changes proposed in Regulations of PG Arts and Science Programmes VTR - PGAS - 2022	Action is being taken to incorporate the corrections as suggested by the members in the Regulations VTR-PGAS-2022.

The Council approved the Action Taken Report.

39.4 To record leave of absence of the members.

The list of members attended the 39th meeting of the Academic Council can be accessed [here](#)



Appendix Attendance

B. Items for Consideration

39.5 To consider and approve the minutes of the Board of Studies of the following discipline:

- Engineering and Technology - Under Graduate & Post Graduate Programmes

a) B.Tech. Aeronautical Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Aeronautical Engineering for **B.Tech. Aeronautical Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.R.Jagan Raj, Associate Professor & Head, Department of Aeronautical Engineering, presented the recommendations of the Board of Studies meeting conducted on March 12, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix Aero

Dr.R.Jagan Raj, Associate Professor & Head, Department of Aeronautical Engineering, moved the recommendations of the Board of Studies of B.Tech. Aeronautical Engineering to be implemented with effect from the Winter semester of the Academic Year 2021-22, be approved.

Dr.Manoj.V.R, Associate Professor & Head, Department of Bio Technology, seconded it.

The motion was carried

b) B.Tech. Bio Medical Engineering

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Bio Medical Engineering for **B.Tech. Bio Medical Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, presented the recommendations of the 4th meeting of the Board of Studies conducted on January 30, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix BIOMED

Dr. N.M. Masoodhu Banu, Professor & Head, Department of Bio Medical Engineering, moved the recommendations of the Board of Studies of B.Tech. Bio Medical Engineering to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. Amala Justus Selvam, Professor & Head, Department of Automobile Engineering, seconded it.

The motion was carried

c) B.Tech. Biotechnology

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Biotechnology for **B.Tech. Biotechnology** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.V.R.Manoj, Associate Professor & Head, Department of Biotechnology, presented the recommendations of the Board of Studies meeting conducted on March 03, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix BIOTECH

Dr.V.R.Manoj, Associate Professor & Head, Department of Biotechnology, moved the recommendations of the Board of Studies of B.Tech. Biotechnology to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

d) B.Tech. Civil Engineering.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Civil Engineering for **B.Tech. Civil Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, presented the recommendations of the Board of Studies meeting conducted on February 25, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix CIVIL

Dr.A. Geetha Selvarani, Professor & Head, Department of Civil Engineering, moved the recommendations of the Board of Studies of B.Tech. Civil Engineering to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. Masoodhu Banu.N.M, Professor & Head, Department of Biomedical Engineering, seconded it.

The motion was carried

e) B.Tech. Computer Science & Engineering.

The Vice Chancellor, placed before the Academic Council to consider the recommendation of the Board of Studies of Department of Computer Science & Engineering for **B.Tech. Computer Science & Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing, presented the recommendations of the Board of Studies meeting conducted on March 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix CSE

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing, moved the recommendations of the Board of Studies of B.Tech. Computer Science & Engineering to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. P. ChandraKumar, Professor & Dean, Industry Relations, seconded it.

f) B.Tech. Computer Science and Design.

The Vice Chancellor, placed before the Academic Council to consider the recommendation of the Board of Studies of Department of Computer Science and Design for **B.Tech. Computer Science and Design** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing , presented the recommendations of the Board of Studies meeting conducted on March 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix CSE

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing , moved the recommendations of the Board of Studies of B.Tech. Computer Science and Design to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. M. Sivakumar, Professor & Dean, Freshman Engineering, seconded it.

The motion was carried.

g) B.Tech. Artificial Intelligence and Machine Learning

The Vice Chancellor, placed before the Academic Council to consider the recommendation of the Board of Studies of Department of Computer Science and Engineering for **B.Tech. Artificial Intelligence and Machine Learning** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix AI&ML

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing , presented the recommendations of the Board of Studies meeting conducted on March 26, 2022.

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing , moved the recommendations of the Board of Studies of B.Tech. Artificial Intelligence and Machine Learning to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. A. Subrahmanyam, Professor & Dean, School of Law, seconded it.

h) B.Tech. Artificial Intelligence and Data Science

The Vice Chancellor, placed before the Academic Council to consider the recommendation of the Board of Studies of Department of Computer Science and Engineering for **B.Tech. Artificial Intelligence and Data Science** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing, presented the recommendations of the Board of Studies meeting conducted on March 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix AI&DS

Dr.V. Srinivasa Rao, Professor & Dean, School of Computing, moved the recommendations of the Board of Studies of B.Tech. Artificial Intelligence and Data Science to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. P. Chandrasekar, Professor & Head, Department of Electrical & Electronics Engineering, seconded it.

The motion was carried.

i) B.Tech. Electrical and Electronics Engineering.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Electrical and Electronics Engineering for **B.Tech. Electrical and Electronics Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix EEE

Dr.P.Chandrasekar, Professor & Head, Department of Electrical and Electronics Engineering, presented the recommendations of the Board of Studies meeting conducted on February 26, 2022.

Dr.P.Chandrasekar, Professor & Head, Department of Electrical and Electronics Engineering, moved the recommendations of the Board of Studies of B.Tech. Electrical and Electronics Engineering to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.N. Lenin, Professor & Head, Department of Mechanical Engineering, seconded it.

The motion was carried.

j) B.Tech. Electronics and Communication Engineering.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Electronics and Communication Engineering for **B.Tech. Electronics and Communication Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, presented the recommendations of the Board of Studies meeting conducted on February 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix ECE

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, moved the recommendations of the Board of Studies of B.Tech. Electronics and Communication Engineering to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.Manoj.V.R, Associate Professor & Head, Department of Bio Technology, seconded it.

The motion was carried.

k) B.Tech. Information Technology.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Information Technology for **B.Tech. Information Technology** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix IT

Dr.C.Mahesh, Professor & Head, Department of Information Technology, presented the recommendations of the Board of Studies meeting conducted on February 26, 2022.

Dr.C.Mahesh, Professor & Head, Department of Information Technology, moved the recommendations of the Board of Studies of B.Tech. Information Technology to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, seconded it.

The motion was carried

l) B.Tech. Mechanical Engineering.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Mechanical Engineering for **B.Tech. Mechanical Engineering** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.N. Lenin, Professor & Head, Department of Mechanical Engineering, presented the recommendations of the Board of Studies meeting conducted on February 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix MECH

Dr.N. Lenin, Professor & Head, Department of Mechanical Engineering, moved the recommendations of the Board of Studies of B.Tech. Mechanical Engineering to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. S.Baskar, Professor, Department of Electrical and Electronics Engineering, seconded it.

The motion was carried

• Law - Under Graduate Programmes

a) B.A.,LL.B. and B.Com., LL.B.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Law for **B.A.,LL.B. and B.Com., LL.B.** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix LAW

Dr. A. Subrahmanyam, Professor & Dean, School of Law, presented the recommendations of the Board of Studies meeting conducted on February 25, 2022.

Dr. A. Subrahmanyam, Professor & Dean, School of Law, moved that "the recommendations of the Board of Studies of **B.A., LL.B. and B.Com., LL.B.** to be implemented with effect from the Winter Semester of the Academic Year 2021-22", be approved.

Dr.G.Sasikala, Professor, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

• Arts and Science - Under Graduate Programmes

a) B.Sc Multimedia.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Media Technology & Communication for **B.Sc Multimedia** to be implemented with effect from the Winter Semester

of the Academic Year 2021-22.

Dr. E. Suresh Paul, Professor & Dean - School of Media Technology & Communication, presented the recommendations of the Board of Studies meeting conducted on February 25, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix MultiMedia

Dr. E. Suresh Paul, Professor & Dean, School of Media Technology & Communication, moved the recommendations of the Board of Studies of B.Sc Multimedia to be implemented with effect from the Summer Semester of the Academic Year 2021-22, be approved.

Dr. R. Jagan Raj, Associate Professor & Head, Department of Aeronautical Engineering, seconded it.

The motion was carried

b) B.Sc Visual Communication

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Media Technology & Communication for **B.Sc Visual Communication** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr. E. Suresh Paul, Professor & Dean - School of Media Technology & Communication, presented the recommendations of the Board of Studies meeting conducted on February 25, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix Viscom

Dr. E. Suresh Paul, Professor & Dean, School of Media Technology & Communication, moved the recommendations of the Board of Studies of B.Sc Visual Communication to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, seconded it.

The motion was carried

c) B.Com.

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Management for **B.Com., General**

to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.B.Jeyaprabha, Professor & Head, School of Management, presented the recommendations of the Board of Studies meeting conducted on March 03, 2022.

The Minutes of the BoS meeting can be accessed [here](#)



Appendix BCom_GEN

Dr.B.Jeyaprabha, Professor & Head, School of Management, moved the recommendations of the Board of Studies of B.Com. to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.R.S. Valarmathi, Professor & Dean - Quality Assurance, seconded it.

The motion was carried

d) Bachelor of Business Administration (B.B.A)

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Management for **Bachelor of Business Administration** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.B.Jeyaprabha, Professor & Head, School of Management, presented the recommendations of the Board of Studies meeting conducted on March 03, 2022.

The Minutes of the BoS meeting can be accessed [here](#)



Appendix BBA

Dr.B.Jeyaprabha, Professor & Head, School of Management, moved the recommendations of the Board of Studies of Bachelor of Business Administration to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, seconded it.

The motion was carried

• Management - Post Graduate (PG) Programmes

a) Masters in Business Administration (M.B.A)

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, moved the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** presented the recommendations of the Board of Studies meeting conducted on March 03, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix MBA

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, moved the recommendations of the Board of Studies of School of Management for **Masters in Business Administration** to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr. Irudayaraj. S, Professor - Mechanical & Dean - Hostel, seconded it.

The motion was carried

b) **Master of Business Administration - Innovation, Entrepreneurship and Venture Development**

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of School of Management for **Master of Business Administration - Innovation, Entrepreneurship and Venture Development** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.M.S.R Mariyappan, Professor & Dean, School of Management, presented the recommendations of the Board of Studies of **Master of Business Administration - Innovation, Entrepreneurship and Venture Development** meeting conducted on February 16, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Dr.M.S.R Mariyappan, Professor & Dean, School of Management, moved the recommendations of the Board of Studies of **Master of Business Administration - Innovation, Entrepreneurship and Venture Development** to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved.

Dr.P.Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, seconded it.

The motion was carried

• **Arts and science- Post Graduate Programmes**

a) **M.A. (English)**

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of English for **M.A. (English)** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr. BINDU. M.R, Professor & Head, Department of English, presented the recommendations of the Board of Studies meeting conducted on February 21, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix English

Dr. BINDU. M.R, Professor & Head, Department of English, moved "that the recommendations of the Board of Studies of **M.A. (English)** to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved".

Dr. Subrahmanyam. A, Professor & Dean School of Law, seconded it.

The motion was carried

b) M.Sc. (Mathematics)

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Mathematics for **M.Sc. (Mathematics)** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.SURESH. M.L, Professor & Head, Department of Mathematics, presented the recommendations of the Board of Studies meeting conducted on February 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix Maths

Dr.SURESH. M.L, Professor & Head, Department of Mathematics, moved "that the recommendations of the Board of Studies of **M.Sc. (Mathematics)** to be implemented with effect from the Winter Semester of the Academic Year 2021-22, be approved".

Dr. M.R. Bindu, Professor & Head, Department of English, seconded it.

The motion was carried

c) M.Sc. (Physics)

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Physics for **M.Sc. (Physics)** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

Dr.D.Senthil Kumar, Associate Professor & Head, Department of Physics, presented the recommendations of the Board of Studies meeting conducted on February 25, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix Physics

Dr.D.Senthil Kumar, Professor & Head, Department of Physics, moved "that the recommendations of the Board of Studies of M.Sc in Physics to be implemented with effect from the Winter semester of the Academic Year 2021-22, be approved".

Dr.C.Mahesh, Professor & Head, Department of Information Technology, seconded it.

The motion was carried

d) M.Sc (Chemistry)

The Vice Chancellor, placed before the Academic Council to consider the recommendations of the Board of Studies of Department of Chemistry for **M.Sc. (Chemistry)** to be implemented with effect from the Winter Semester of the Academic Year 2021-22.

DR. C. Hazarathaiyah Yadav, Associate Professor & Head, Department of Chemistry, presented the recommendations of the Board of Studies meeting conducted on February 26, 2022.

The Minutes of the BoS meeting

can be accessed [here](#)



Appendix Chemistry

DR. C. Hazarathaiyah Yadav, Associate Professor & Head, Department of Chemistry, moved "that the recommendations of the Board of Studies of M.Sc. (Chemistry) to be implemented with effect from the Winter semester of the Academic Year 2021-22, be approved".

Dr. Irudayaraj. S, Professor - Mechanical & Dean - SOMC, seconded it.

The motion was carried

39.6 To discuss and approve the UG & PG programmes to be offered for the Academic Year 2022-23.

The Vice Chancellor, placed before the Academic Council to discuss and approve the UG & PG programmes to be offered for the Academic Year 2022-23

Dr.E. Kannan, Professor & Registrar, presented the UG & PG programmes to be offered for the Academic Year 2022-23.

UG & PG programmes can be

accessed [here](#)



Appendix UG&PG

A. Under Graduate Programme**1. New Course**

Table 2: New Course

S.No.	Name of the Course	AICTE Approved Intake for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)	-	-	60
2	COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)	-	-	60
3	COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)	-	-	60
Grand Total		-	-	180

2. Reduction

Table 3: Reduction

S.No.	Name of the Course	AICTE Approved Intake for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	AERONAUTICAL ENGINEERING	90	34	60
2	ELECTRONICS & COMMUNICATION ENGINEERING	570	656	480
3	MECHANICAL ENGINEERING	120	54	60
Grand Total		780	744	600

3. Offering programme

Table 4: Offering programme

S.No.	Name of the Course	AICTE Approved Intake for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE	60	69	60
2	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	60	69	60
3	COMPUTER SCIENCE AND DESIGN	60	69	60
4	COMPUTER SCIENCE & ENGINEERING	960	1104	960

5	CIVIL ENGINEERING	60	32	60
6	ELECTRICAL AND ELECTRONICS ENGINEERING	60	24	60
7	INFORMATION TECHNOLOGY	60	69	60
8	BIOTECHNOLOGY	60	53	60
9	BIOMEDICAL ENGINEERING	60	23	60
	Grand Total	1440	1512	1440

B. Post Graduate Programme

Table 5: Post Graduate Programme

S.No.	Name of the Course	AICTE Intake Applied for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	AERONAUTICAL ENGINEERING (Unmanned Aerial Vehicles)	18	6	18
2	BIG DATA ANALYTICS	18	8	18
3	BIOTECHNOLOGY	18	12	18
4	COMPUTER SCIENCE AND ENGINEERING	18	7	18
5	EMBEDDED SYSTEMS AND TECHNOLOGIES	18	8	18
6	ENVIRONMENTAL ENGINEERING	18	6	18
7	INDUSTRIAL SAFETY AND ENGINEERING	18	18	18
8	INFORMATION AND CYBER SECURITY	18	7	18
9	METALLURGICAL AND MATERIAL SCIENCE ENGINEERING	18	10	18
10	NETWORK ENGINEERING	18	1	18
11	POWER ELECTRONICS	18	6	18
12	STRUCTURAL ENGINEERING	18	9	18
	Grand Total	216	98	216

C. MBA - Post Graduate Programme

Table 6: MBA - Increase in Intake

S.No.	Name of the Course	AICTE Approved Intake for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	MBA	90	88	120
	Grand Total	90	88	120

D. Grand Total as per AICTE

Table 7: Grand Total

S.No	Description	No. of Courses	Total Intake 2021-22	Total Intake 2022-23
1	UG - Total No. of Courses & Intake for the Year (AICTE)	15	2220	2220
2	PG - Total No. of Courses & Intake for the Year (AICTE)	13	336	336
Grand Total		28	2556	2556

* The Institution has also applied for 15% additional Intake AICTE

E. Arts and Science Programme**1. UNDER GRADUATE - Arts and Science**

Table 8: UNDER GRADUATE - Arts and Science

S.NO	PROGRAMME	AICTE Intake Applied for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	BACHELOR OF COMMERCE	120	110	120
2	BACHELOR OF BUSINESS ADMINISTRATION	30	28	30
3	B.A.,LL.B.(Hons)	120	120	120
4	B.COM.,LL.B.(Hons)	120	91	120
5	BACHELOR OF SCIENCE (VISUAL COMMUNICATION)	30	14	30
6	BACHELOR OF SCIENCE (MULTIMEDIA)	30	9	30
Total		450	372	450

2. POST GRADUATE - Arts and Science

Table 9: POST GRADUATE - Arts and Science

S.NO	PROGRAMME	AICTE Intake Applied for 2021-22	Student admitted for 2021-22	Proposed Intake for 2022-23
1	M.A.(English)	30	14	30
2	M.SC(CHEMISTRY)	30	30	30
3	M.SC(DATA ANALYTICS)	30	12	30
4	M.SC(MATHS)	30	8	30
5	M.SC(PHYSICS)	30	22	30
Total		150	86	150

Dr.E.Kannan, Professor & Registrar, moved that "the approval of UG & PG programmes to be offered for the Academic Year 2022-23", be approved.

Dr. M. Sivakumar, Professor & Dean, Freshman Engineering, seconded it.

The motion was carried

C. Items for Ratification

39.7 To ratify the admissions under Re-Admission category for Winter Semester of the Academic Year 2021-22.

The Vice Chancellor, placed before the Academic Council to ratify the list of students admitted through "Re-Admission category" in Winter Semester of the Academic Year 2021-22.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Re Admission category in Winter Semester of the Academic Year 2021-22.

Table 10: List of students admitted through Re Admission category

S.No.	Batch	ID No.	Name	Programme	Branch
1	2020-21	VTA 1115	A.PAVITHRA PRAKASH	B.Sc	Multimedia
2	2020-21	VTA 1104	S.GAIUS GOODWIN	B.Sc	Multimedia
3	2019-20	VTA 701	S.A.SWETHA	B.Sc	Visual Communication
4	2019-23	VTU 15143	AMAN MISHRA	B.TECH	CSE
5	2019-23	VTU 12631	KALIVARATHAN	B.TECH	IT
6	2020-25	VTA 1141	A.VIKRAM	B.Com LLB (Hons.)	
7	2018-20	VTP 2384	P R JEEVARATHINAM	M.TECH	POWER ELECTRONICS

Dr.E. Kannan, Professor & Registrar, moved that "the list of students admitted through Re Admission category in Winter Semester of the Academic Year 2021-22", be ratified.

Dr.R.Sivaraman, Professor & Controller of Examinations, seconded it.

The motion was carried and the members approved

39.8 To ratify the admissions under Institution Transfer category for Winter Semester of the Academic Year 2021-22.

The Vice Chancellor, placed before the Academic Council to ratify the list of students admitted through "Institution Transfer category" in Winter Semester of the Academic Year 2021-22.

Dr.E. Kannan, Professor & Registrar, presented that the list of students admitted through Institution Transfer category in Winter Semester of the Academic Year 2021-22.

Table 11: Institute Transfer Student List

S.NO	VTU	DEPT	NAME	Migration From	Year / Sem
1	VTU 21666	CIVIL	LOLLA VENKATA SAI VAISHNAVI	SRI CHNDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA (SCSVMV)	II/IV

Dr.E. Kannan, Professor & Registrar, moved that "the list of students admitted through Institution Transfer category in Winter Semester of the Academic Year 2021-22", be ratified.

Dr. V. Srinivasa Rao, Professor & Dean, School of Computing, Computer Science & Engineering, seconded it.

The motion was carried

39.9 To ratify the examination results of Semester End Examination held during the Summer Semester of AY 2021-22.

The Vice Chancellor, placed before the Academic Council to record the result analysis of the Semester end examination held during Summer Semester of the Academic Year 2021-22.

Dr. R. Sivaraman, Controller of Examinations, presented the UG / PG Programmes result analysis of the courses offered in Summer Semester of AY 2021-22.

result analysis of the Summer
Semester of AY 2021-22 can be

accessed [here](#)



**Appendix Result
Analysis**

Table 12: B.TECH. - Total No. of courses for which the exams are conducted

Course	AERO	AUTO	BIO MED	BIO TECH	CIVIL	CSE	ECE	EEE	IT	MECH
Foundation	47									
Programme Core	17	11	17	22	16	22	27	19	13	12
Programme Elective	12	9	7	10	4	20	21	6	2	5
Allied Elective	2	6	1	2	2	3	1	7	1	2
Institute Elective	2	7	5	9	4	3	3	6	1	2
Total	33	33	30	43	26	48	52	38	17	21
	388									

Dr. R. Sivaraman, Controller of Examinations, moved that "the result analysis of the semester end examination held during Summer Semester of the Academic Year 2021-22", be ratified.

Dr.P.Chandrasekar, Professor & Head, Department of Electrical & Electronics Engineering, seconded it.

The motion was carried

39.10 To ratify the admissions of candidates to Doctoral(Ph.D.) level programmes in Engineering and Technology/ Science / Law / Management / Humanities /Arts for Academic Year 2021-22.

The Vice Chancellor, placed before the Academic Council to ratify the admissions of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science /Law / Management/ Humanities / Arts for Academic Year 2021-22.

Dr. S. Koteeswaran, Professor & Dean - Research Studies, presented the admissions of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science /Law / Management/ Humanities / Arts for Academic Year 2021-22.

1. Summary of Ph.D. National Admission AY 2021-22 (Winter Session)

Table 13: National Admission AY 2021-22 (Winter Session)

S.No	DEP'T	Research Supervisor Vacancy Positions	Appl-ied	Short-listed	Eligible for Entrance Exam	Selected in Inter-view	FT	PT - INT	PT - EXT	Total
1	AERO	1	2	2	1	1	0	0	1	1
2	AUTO	17	1	1	1	1	0	0	1	1
3	CIVIL	9	5	5	5	2	1	0	1	2
4	MECH	147	14	12	12	5	1	0	3	4
5	IT	1	1	1	1	1	0	1	0	1
6	CSE	71	35	32	29	26	1	10	9	20
7	ECE	116	20	20	20	14	2	3	7	12
8	EEE	15	6	6	6	5	0	3	1	4
9	BIO TECH	21	4	4	4	4	2	1	1	4
10	BIO MEDICAL	17	2	2	1	1	0	0	0	0
11	ENGLISH	8	4	3	2	1	0	0	0	0
12	MATHS	65	11	11	5	4	2	1	0	3
13	PHYSICS	49	4	3	0	3	0	1	2	3
14	CHEM	38	4	4	3	1	0	1	0	1
15	LAW	6	13	12	12	6	0	4	2	6
16	MBA	0	2	0	0	0	0	0	0	0
TOTAL		581	128	118	102	75	9	25	28	62

2. Summary of Ph.D. International Admission AY 2021-22 (Winter Session)

Table 14: International Admission AY 2021-22 (Winter Session)

S.No	Dept's	Research Supervisor Vacancy Positions	App-plied	Short-listed	Eligible	Selected	Full Time	Country
1	AERO	1	0	0	0	0	0	-
2	AUTO	17	0	0	0	0	0	-
3	CIVIL	9	1	1	1	1	1	Syria - 1
4	MECH	147	1	1	1	1	1	Ethiopia - 1
5	IT	1	0	0	0	0	0	-
6	CSE	71	3	2	2	0	0	-
7	ECE	116	0	0	0	0	0	-
8	EEE	15	1	1	1	0	0	-
9	BIO TECH	21	3	2	2	0	0	-
10	BIO MED	17	0	0	0	0	0	-
11	ENG	8	1	1	1	0	0	-
12	MATHS	65	1	1	1	0	0	-
13	PHYSICS	49	0	0	0	0	0	-
14	CHEM	38	0	0	0	0	0	-
15	LAW	6	0	0	0	0	0	-
16	MBA	0	9	0	0	0	0	-
TOTAL		581	20	9	9	2	2	Syria-1 Ethiopia-1

Dr.S.Koteeswaran, Professor & Dean - Research Studies, moved that "the Admissions of Ph.D Students during the Summer semester of Academic year 2021-22", be ratified.

Dr. A. Subrahmanyam, Professor & Dean, School of Law, seconded it.

The motion was carried

D. Items for Reporting

39.11 To report starting of new programmes and closure of a few non viable programmes with effect from the Academic Year 2022-23.

The Vice Chancellor, placed before the Academic Council to report starting of new programmes and closure of a few non viable programmes with effect from the Academic Year 2022-23.

Dr.E. Kannan, Professor & Registrar, presented that the list of starting of new programmes and closure of a few non viable programmes with effect from the Academic Year 2022-23.

1. Starting of New Programmes

Table 15: Starting of New Programmes

S.No	Name of the Programme	Count
1	CSE (AI & ML)	60
2	CSE (Data Science)	60
3	CSE (Cyber Security)	60
	Total	180

2. Reduction of Intake

Table 16: Reduction of Intake

S.No	Name of the Programme	From	To	Difference
1	Mechanical Engineering	120	60	60
2	Aeronautical Engineering	90	60	30
3	Electronics and Communication Engineering	570	480	90
	Total			180

3. Closure of non-viable programmes

Table 17: Closure of non-viable programmes

S.No	Name of the Programme	Count
1	MBA (IEV)	30

4. Increase of Intake

Table 18: Increase of Intake

S.No	Name of the Programme	Previous Intake	New Intake
1	MBA	90	120

5. Approval from Govt. of Tamilnadu

Table 19: Approval from Govt. of Tamilnadu

S.No	Name of the Programme	Previous Intake	New Intake
1	M.Tech (Industrial Safety and Engineering)	30	30

Applied and obtained approval from the Director of Industrial Safety and Health (FAC), Department of Labour Welfare and Skill development, Govt. of Tamilnadu on February 11, 2022.

Approval of M.Tech (Industrial Safety and Engineering) can be accessed [here](#)



**Appendix Approval of M.Tech
(Industrial Safety and
Engineering)**

Dr.E. Kannan, Professor & Registrar, moved that "the list of starting of new programmes and closure of a few non viable programmes with effect from the Academic Year 2022-23", be reported.

Dr.Carmel Mary Belinda, Professor & Dean Academics, seconded it.

The motion was carried

39.12 To report the results of the Ph.D. viva voce conducted since last Academic Council held on December 23, 2021.

The Vice Chancellor, placed before the Academic Council to ratify the results of the Ph.D. viva voce conducted since last Academic Council held on December 23, 2021.

Dr. R. Sivaraman, Controller of Examinations, presented the results of the Ph.D. viva voce conducted since last Academic Council held on December 23, 2021.

Ph.D. viva voce list can be accessed



Appendix Ph.D. List

Table 20: Ph.D viva-voce completed candidate name list

S.No	Name	Dept	Viva-voce Date	Supervisor Name	Title
1	B. Komala Durga	MATHS	12.01.2022	Dr. E. Chand-rasekaran	Development of Inventory Models for Substitutable and Complementary Products under Quadratic Demand
2	R Lakshmi	EEE	20.01.2022	Dr. K Karuna-nithi	Investigations on Interleaved Forward DC to DC Converters
3	Dileepan D	ECE	17.02.2022	Dr. S. Natarajan	Design of Compact CPW-FED Multiband Antennas for WLAN, WIMAX and SUB-6 GHZ 5G Applications
4	Lokhande Ramdas Alias Pravin Ravindra	MECH	01.03.2022	Dr. Sachin S.Salunkhe	Mechanical Investigations in Root Canal Preparation and Obturation Process
5	M. Sundarraj	MECH	03.03.2022	Dr. M. Mei-kandan	Conversion of Waste Plastics into Liquefied Fuel by Titanium based Catalyst
6	Mary Jiny D (FT-INT)	MATHS	09.03.2022	Dr. R. Shan-mugapriya	A Study on Fuzzy Resolving Set of Fuzzy Graphs and its Applications
7	S. Sabeetha Saraswathi	CSE	11.03.2022	Dr. N. Malar-vizhi	Secured Data Deduplication Techniques for Optimal Storage Management in Cloud

8	P Revathi	ENGLISH	06.04.2022	Dr. M.R.Bindu	Intrepid Voice of Dalits as a Tumultuous Uproar of Multitudes through Autobiography and Memoir
9	Harish Pasupulati	ECE	21.04.2022	Dr. S. Baskar	Modelling and Diagnosis of Brain Tumour using Intelligent Techniques
10	D. Sugumaran	CSE	22.04.2022	Dr. C.R. Bharathi	AMBA: Adaptive Monarch Butterfly Algorithm based Information Transfer Scheduling in cloud for Big Data Applications
11	K.A. Harish	MANA-GEMENT	26.04.2022	Dr. B. Jeya Prabha	Analysis of Teachers Stress and its Impact on Institutional Performance of Government and Private Schools in Chennai
12	K. Aanandha Saravanan	ECE	27.04.2022	Dr. P. Suresh	Energy Efficient Adaptive Quorum based MAC Protocol for Heterogeneous Wireless Sensor Network

Dr. R. Sivaraman, Controller of Examinations, moved that "the results of the Ph. D. viva voce conducted since last Academic Council held on December 23, 2021", be ratified.

Dr.C.Mahesh, Professor & Head, Department of Information Technology, seconded it.

The motion was carried

39.13 To report the Strategic Plan 21-26 of this Institution.

The Vice Chancellor, placed before the Academic Council to report the Strategic Plan 21-26 of this Institution.

Dr.E. Kannan, Professor & Registrar, presented that the report of the Strategic Plan 21-26 of this Institution.

Report of the Strategic Plan 21-26 of this Institution can be accessed



Appendix Strategic Plan

Dr.E. Kannan, Professor & Registrar, moved that "the report of Strategic Plan 21-26 of this Institution", be reported.

Dr. P. Esther Rani, Professor & Head, Department of Electronics and Communication Engineering, seconded it.

The motion was carried.

39.14 To record the progression and achievements of the following Schools :

The Vice Chancellor, placed before the Academic Council to report the progression of School of Computing and School of Science and Humanities and their academic achievements.

A) School of Computing

Dr. V. SRINIVASA RAO, Professor & Dean School of Computing, presented the Progression of the School of Computing and academic achievements.

Dr. V. SRINIVASA RAO, Professor & Dean School of Computing, moved that "the Progression of School of Computing and academic achievements", be recorded.

Dr.V.Jayasankar, Professor & Dean School of Electrical and Communication, seconded it.

The motion was carried.

B) School of Sciences and Humanities

Dr. M. Sivakumar, Professor & Dean School of Sciences and Humanities , presented the Progression of the School of Sciences and Humanities and their academic achievements.

SoSH Presentations can be accessed [here](#)



**Appendix
Presentation**

Dr. M. Sivakumar, Professor & Dean School of Sciences and Humanities , "moved the Progression of School of Sciences and Humanities and their academic achievements", be recorded.

Dr. A. Subrahmanyam, Professor & Dean, School of Law, seconded it.

The motion was carried

39.15 To report the activities of the office of Campus to corporate.

The Vice Chancellor, placed before the Academic Council to report the activities of the office of Campus to corporate.

Mr. P. Vijayaraman, Dean - Campus to Corporate, presented the report the activities of the office of Campus to corporate.

Presentations of campus to corporate can be accessed [here](#)



**Appendix
Presentation**

Mr. P. Vijayaraman, Dean - Campus to Corporate, moved that "the report of the activities of office of Campus to corporate.", be reported.

Dr.P. Chandrakumar, Professor & Dean - Industry Relations,seconded it.

The motion was carried

E. Closing

39.16 Anyother items with the permission of the Chairperson

39.17 To decide the date of holding the next meeting of the Academic Council.

40th Regular Meeting of the Academic Council is tentatively scheduled on Saturday, **September 24, 2022.**

39.18 Vote of Thanks.

Dr. E. Kannan, Professor & Registrar, expressed his thanks to all the members of the Academic Council for their presence and valuable contributions.

39.19 Adjournment

The meeting was adjourned at 2 PM.

Vel Tech Rangarajan & Dr.Sagunthala R&D Institute of Technology
Department of Bio Medical Engineering (VTUR21 Curriculum)

Foundation Courses of VTUR21						
Sl. No.	Course Code	Course Name	Class distribution per week			C
			L	T	P	
1	10210PH102	Physics of Materials	3	0	0	3
2	10210CH102	Bio Chemistry	3	0	0	3
3	10210CS101	Problem Solving using C	3	0	0	3
4	10210ME101	Design thinking	2	0	0	2
5	10210MA201	Matrices & Calculus	2	0	2	3
6	10210EN201	Professional Communication - I	1	0	2	2
7	10210ME201	Engineering Graphics	1	0	4	3
8	10210CH301	Engineering Chemistry Lab	0	0	2	1
9	10210EE301	Engineering Products Lab	0	0	2	1
10	10210CS301	Problem Solving using C Lab	0	0	2	1
11	10210PH103	Applied Physics	2	0	0	2
12	10210BM101	Biology for Engineers	2	0	0	2
13	10210MA203	Vector Calculus & Complex variable	2	0	2	3
14	10210EN202	Professional Communication - II	1	0	2	2
15	10210EE202	Basic Electrical & Instrumentation Engineering	2	0	2	3
16	10210EE204	Introduction to Engineering	1	0	4	3
17	10210CS201	Python Programming	1	0	2	2
18	10210PH302	Applied Physics Laboratory	0	0	2	1
19	10210CS303	IT Workshop	0	0	2	1
20	10210MA104	Fourier Series & Transform techniques	3	0	0	3
21	10210CH103	Environmental Studies	2	0	0	2
22	10210ME102	Universal Human Values	3	0	0	3
23	10210ME103	Innovation & Entrepreneurship	2	0	0	2
24	10210ME104	Project Management & Finance	2	0	0	2
25	10210MA106	Probability & Random Process	3	0	0	3
			Total			56
26		Induction Cum Acquaintance Program	0	0	2	M
27	10210BL101	Constitution of India	1	0	0	M
28	10210ME105	Engineer and Society	1	0	0	M

S.No	Course Code	Program Core	Class distribution per week			C
			L	T	P	
1	10211BM101	Anatomy and Human Physiology	3	0	0	3
2	10211BM102	Analog and Digital Circuits	2	2	0	3
3	10211BM103	Electric Circuit Theory	2	2	0	3
4	10211BM104	Engineering Mechanics	2	2	0	3
5	10211BM105	Bio Sensors and Transducers	3	0	0	3
6	10211BM106	Control systems	3	2	0	4
7	10211BM107	Microcontroller and Digital Signal Processor	2	2	0	3
8	10211BM108	Digital Signal Processing	2	2	0	3
9	10211BM109	Biomaterials	3	0	0	3
10	10211BM110	Bio Medical Instrumentation	3	0	0	3
11	10211BM111	Diagnostic and Therapeutic Equipments	3	0	0	3
12	10211BM112	Radiological Equipments	3	0	0	3
			Total			37
Program Core Integrated Courses						
13	10211BM201	Pathology and Microbiology	2	0	2	3
14	10211BM202	Artificial Neural Networks	3	0	2	4
15	10211BM203	Biomechanics	2	0	2	3
16	10211BM204	Image Processing	3	0	2	4
			Total			14
Laboratory Courses						
17	10211BM301	Biochemistry and Physiology Laboratory	0	0	2	1
18	10211BM302	Analog and Digital Circuits Laboratory	0	0	2	1
19	10211BM303	Sensors and Transducers Laboratory	0	0	2	1
20	10211BM304	Microcontrollers and DSP Processor Laboratory	0	0	2	1
21	10211BM305	Digital Signal Processing Laboratory	0	0	2	1
22	10211BM306	Biomedical Instrumentation Laboratory	0	0	2	1
23	10211BM307	Diagnostic and Therapeutic Equipments Laboratory	0	0	2	1
			Total			7
Total Credits						58

S.No	Course Code	Program Electives	Class distribution per week			C
			L	T	P	
1	10212BM101	Hospital Management	3	0	0	3
2	10212BM102	Telehealth Technology	3	0	0	3

3	10212BM103	Medical Ethics	3	0	0	3
4	10212BM104	Body Area Networks	3	0	0	3
5	10212BM105	Introduction to Nanotechnology	3	0	0	3
6	10212BM106	Rehabilitation Engineering	3	0	0	3
7	10212BM107	Robotics in Medicine	3	0	0	3
8	10212BM108	Biomedical Informatics	3	0	0	3
9	10212BM119	Medical optics	3	0	0	3
10	10212BM120	Medical Device Regulatory Affairs	3	0	0	3
11	10212BM121	Tissue Engineering	3	0	0	3
Program Elective Integrated Courses						
12	10212BM201	Digital Imaging and Communication in Medicine	1	0	4	3
13	10212BM202	Brain-Computer Interface	1	0	4	3
14	10212BM203	Biomedical Computational Modelling	1	0	4	3

S. No	Course Code	Specialization	Class distribution per week			C
			L	T	P	
Major (AI in Healthcare)*						
1	10212BM109	Introduction to Machine Learning	2	2	0	4
2	10212BM204	Introduction to Deep Learning	3	0	2	4
3	10212BM110	Natural Language Processing	3	0	0	3
4	10212BM304	Essential Python Modules for Machine Learning Laboratory	0	0	2	1
5	10212BM122	High-Performance Computing	3	0	0	3
6	10212BM123	Computer Vision*	3	0	0	3
*yet to be framed					Total	18
Honors (Precision Healthcare Technology)						
1	10212BM205	Foundations of Data Science and R	3	0	2	4
2	10212BM111	Inferential Analysis and Machine Learning	3	0	0	3
3	10212BM112	Precision Medicine in Chronic Diseases	3	0	0	3
4	10212BM301	Inferential Medical Data Analytics Using R	0	0	4	2
5	10212BM113	Predictive Analysis of Medical Data	3	0	0	3
6	10212BM114	Healthcare Operations Research	3	0	0	3
					Total	18
Minor (Brain-Computer Interface)						
1	10213BM110	Neurophysiology	2	0	0	2
2	10213BM111	Introduction to BCI and Signal Acquisition Methods	3	0	0	3
3	10213BM112	Digital Signal Processing	3	2	0	4
4	10213BM203	BCI Feature Extraction & Translation	3	0	2	4
5	10213BM302	BCI Data Analysis with MNE	0	0	2	1
6	10213BM113	BCI-Applications and Ethics	3	0	0	3
7	10213BM303	EEG Recording & Analysis Laboratory	0	0	2	1
					Total	18

S.No	Course Code	Open Electives	Class distribution per week			C
			L	T	P	
1	10213BM201	Bio Signal Processing Instrumentation	2	0	2	3
2	10213BM202	Brain Computer Interface	2	0	2	3
3	10213BM101	Body Area Networks	3	0	0	3
4	10213BM102	Environmental Conservation	3	0	0	3
5	10213BM103	Telehealth Technology	3	0	0	3
6	10213BM104	Medical Instrumentation	3	0	0	3
7	10213BM105	Drone in Healthcare	3	0	0	3
8	10213BM301	Biomedical Lab	0	0	2	1
MOOC COURSE						
9	10213BM106	Data Management for clinical research				
10	10213BM107	Biophotonics				
11	10213BM108	BioMEMS and Microfluidics				
12	10213BM109	Organ printing				

*** syllabus to be framed**

Program Educational Objectives

Our Graduates will be

1. Employed in Biomedical Engineering related fields or in other career fields in industry, government organizations or academe (Career accomplishment)
2. Able to continue to enhance their professional skills in their chosen profession by participating in professional organizations, completing additional college courses, or completing industry-sponsored short courses. (Professional accomplishment)
3. Active members to serve the society (Professional)
4. Solve critical problems in the domain of biomedical engineering (Professional)

Program Outcomes

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage

Program specific outcomes

1. Apply critical reasoning to identify, solve, design solution for problems in BCI biomedical engineering;
2. Design an effective interface between living and non living things

Course Code	Course Title	L	T	P	C
10211BM101	Anatomy and Human Physiology	3	0	0	3

a) Course Category

Program core

b) Preamble

Knowledge of Human anatomy and physiology is essential for a biomedical engineer in order to design any biomedical instruments. This course gives a basic knowledge about human anatomy

c) Prerequisite

Biology for Engineers

d) Related Courses

Pathology and microbiology

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe basic structural and functional elements of human body	K2
CO2	Analyze the mechanics of respiration with respect to various respiratory parameters	K3
CO3	Explain the mechanics in the circulatory system	K2
CO4	Describe the Kidney function, eye and ear senses	K2
CO5	Explain nervous system and its types	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1						1						1
CO2	3	1				1		1				1		1

CO3	3	1				1		1				1		1
CO4	3	1				1		1				1		1
CO5	3	1				1		1				1	2	1

f) Course content

UNIT I INTRODUCTION TO TISSUE STRUCTURE

9

Tissue – epithelial, connective, muscle-skeletal muscle – structure, contractile elements, properties, smooth muscle – structure and types.

Introduction to Skeletal system – types of bones and joints, membranes and cavities of the body

UNIT II RESPIRATORY SYSTEM

9

Components of respiratory system- organs of respiration, non-respiratory functions of the lung – **filtration of air**. Respiratory Mechanics – respiratory movements, muscles of respiration, movement of lungs and thoracic cage, respiratory pressures, compliance. Lung volumes, capacities and its measurements. Ventilation – pulmonary, alveolar, dead space. Gas exchange – internal and external, Transport of respiratory gases, Regulation of respiration..

UNIT III CARDIOVASCULAR SYSTEM

9

Blood – plasma, formed elements, erythropoiesis. Blood vessels – types and structure,

Structure of heart – internal and external, Properties of cardiac muscle. Cardiac cycle – atrial and ventricular events, pressure changes during cardiac cycle, cardiac output. Pulse – Arterial and venous pulse, Heart sound, Blood pressure – Arterial, venous and capillary pressure, Circulation of blood.

UNIT IV URINARY AND SPECIAL SENSORY SYSTEM

9

Urinary system: Structure of kidney and nephron, juxtaglomerular apparatus, Renal circulation – auto regulation and special features. Mechanism of Urine formation: Glomerular filtration, tubular reabsorption, tubular secretion, acidification of urine, micturition.

Special senses: Eye – structure of eye, intraocular pressure, ocular muscle and movements, function of rods and cones. Ear – structure of ear, auditory pathway.

UNIT V NERVOUS SYSTEM

9

Structure of a Neuron – Types of Nerve. Synapse and neurotransmitters. Conduction of action potential in neuron. Brain – Cerebrum – brain stem –cerebellum. Spinal cord – Tracts of spinal cord, Autonomic nervous system.

Total 45 Hrs.

g) Learning Resources

Text Books

[1] Sembulingam, Kirma, and Prema Sembulingam. *Essentials of medical physiology*. JP Medical Ltd, 2012.

[2] Waugh, Anne, Allison Grant, and Janet S. Ross. *Ross and Wilson anatomy and physiology in health and illness*. Churchill livingstone, 2002.

Reference Books

- [1] Pocock, Gillian, and Christopher D. Richards. *The human body: an introduction for the biomedical and health sciences*. Oxford University Press, 2009.
- [2] William, F. G. *Review of medical physiology*. McGraw Hill, 2005.

Course Code	Course Title	L	T	P	C
10211BM102	Analog and Digital Integrated Circuits	2	2	0	3

a) Course Category

Program core

b) Preamble

Every medical instrument whether it is diagnostic or therapeutic does not come without basic electronics circuits like an Instrumentation amplifier. This course gives an insight into the design of such equipment

c) Prerequisite

Basic Electronics Engineering.

d) Related Courses

Microprocessor and Microcontroller, Sensors and Transducers, Circuit Theory.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Design Biasing circuits for Transistor Design simple mathematical circuits using opamp	K3
CO2	Design various wave shaping circuits with op amp and 555 timers	K3
CO3	Solve problems on number system Use Boolean algebra to simplify digital circuits	K3
CO4	Apply the concept of counters, flip flops, registers and combinational logic in digital circuits	K3
CO5	Solve problems on A/D and D/A converters	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1									1	2	
CO2	3	2	1									1	2	
CO3	3	1	1									1	1	
CO4	3	2	1		1					1		1	1	
CO5	3	1	1		1				1			1	1	

UNIT I BJT, FET, and OP-AMP

12

Transistor as an amplifier, Methods of Transistor biasing- fixed bias, voltage divider, Emitter feedback bias and Bias stability. Biasing the FET, Biasing MOSFET. Characteristics and applications of operational amplifiers - difference amplifier, adder, subtractor, integrator, differentiator, instrumentation amplifier.

UNIT II Oscillators and 555 Timer

12

Oscillators- Classification of Oscillators, Barkhausen Criterion, General form of an LC Oscillator, Hartley oscillator, Colpitts oscillator, Tuned Collector Oscillator, RC oscillator, Wein-Bridge Oscillator, waveform generator, Multivibrators. Introduction to 555 timer; Astable and monostable operation of 555 timer, Schmitt Trigger using 555 timer, Applications of 555 in Astable and Monostable operation

UNIT III Number system & Boolean algebra

12

Number system; Base conversion methods; compliments- 1's and 2's compliment, Codes- BCD- 2421- Excess 3- Gray and ASCII, [Error detection and Error Correction using Hamming Code] Boolean Algebra: Basic theorems and properties- Boolean laws and De-Morgan's theorem, Canonical & Standard form, Boolean algebraic simplification and realizing using logic gates, K-Map.

UNIT IV Combinational Logic, Sequential Machine and Circuit Analysis 15

Combinational Logic: Introduction- Arithmetic circuits, Comparators, Decoders and encoders, Multiplexers and De-multiplexers. Fundamentals of sequential machine operation, Storage elements- Latches & Flip-flops (D-Flip-flop, T-Flip-flop, J-K flip-flop and Clocked flip-flops), Counters-Design of single mod counter- ripple counter- ring counters, Registers- Shift register sequences. State Diagram, Approaches to the design of synchronous sequential finite state machines (ASM); State reduction steps.

UNIT V Signal Conversion

9

A/D and D/A converters: Weighted-resistor D/A converter; R-2R Ladder D/A converter; Parallel comparator A/D converter; Successive-approximation A/D converter.

Total: 60 Hrs

g) Learning Resources

Text Books

[1] S Salivahanan, N Suresh Kumar. *Electronic Devices and Circuits*. McGraw Hill, 2016.

[2] D. Roy Chowdary, Sheil B Jani. *Linear Integrated circuits*. New age publication, 2003.

[3] Mano, M. Morris. *Digital Design*. Pearson Education India, 2006.

Reference Books

[1] Jacob Milliam Halkias. *Electronic devices and circuits*. Printis Hall Publication, 2010.

[2] Allan Mottershed. *Electronic devices and circuits an introduction*. Printis Hall Publication, 2011.

[3] Donald P Leach. *Digital principles and applications*. Pearson Education India, 2011.

Course Code	Course Title	L	T	P	C
10211BM103	Electric Circuit Theory	2	2	0	3

a) **Course Category**

Program core

b) **Preamble**

Any analog circuit design/debugging needs thorough analysis of current and voltage at each point. This course introduces knowledge background needed for designing any electronic circuit or solving any problems encountered in the electronic circuit

c) **Prerequisite**

None

d) **Links to other courses**

Analog Electronics and Integrated Circuits

e) **Course Outcomes**

Upon successful completion of the course the students will be able to

CO Nos.	Course outcome	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Solve circuits for current and voltage using simple mesh and node analysis and theorems	K3
CO2	Reduce the complicated circuit to an equivalent simple circuit	K3
CO3	Compute the resonance frequency of series and parallel resonance circuits	K3
CO4	Solve the problems of Coupled circuits	K3
CO5	Solve problems on how RL, RC an RLC circuits behave with respect to time domain for both DC / AC input	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2										1	
CO2	3	3	2										1	
CO3	3	3	2										1	
CO4	3	3	2										2	
CO5	3	3	2										2	

f) Course Content

UNIT-I Basic Circuit Analysis

12

Ohm's Law – Kirchhoff's laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C Circuits and Fundamental A.C. circuits

UNIT-II Network Reduction and Theorems for DC Circuits

12

Network reduction: voltage and current division in DC circuits, source transformation Technique– star delta conversion. Thevenin's and Norton & Theorem – Superposition Theorem – Maximum power transfer theorem– Reciprocity Theorem.

UNIT-III Resonance Circuits

12

Introduction to Resonance circuits, Resonant Tuned Circuits, Series and parallel resonance-resonant frequency- quality factor- bandwidth, Comparison of series and parallel resonant circuits.

UNIT-IV Coupled Circuits

12

Introduction to Coupled Circuits, Self-Inductance, Mutual Inductance, Modeling of coupled circuits, Dot convention in coupled coils, Series connection of coupled coils, Parallel connection of coupled coils, Equivalent T-network for mutually coupled circuits.

UNIT-V Transient Response

12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

Total: 60 Hrs

g) Learning Resources

Text Books

[1] Arumugam, Prem Kumar. *Electric Circuit Theory*. Khanna Publishers, 2000.

[2] Joseph Edminister. *Schaum's outline series: Electric Circuits*. McGraw Hill, 2013.

Reference Books

[1] A.Chakrabarti. *Circuit Theory – Analysis and Synthesis*. Dhanpat Rai & Co. New Delhi, 2006.

[2] Hayt W.H, Kemmerley J.E. *Engineering Circuit Analysis*. McGraw Hill, 2002.

Course Code	Course Title	L	T	P	C
10211BM104	Engineering Mechanics	2	2	0	3

a) Course Category

Program core

b) Preamble

This course provides an introduction to the basic concepts of forces, inertias, centroids, and moments of area and techniques of finding their effects on motion. It introduces the phenomenon of friction and its effects. It introduces students to cognitive learning in applied mechanics and develops problem-solving skills in both theoretical and engineering oriented problems.

c) Pre-Requisite

Engineering Mathematics - I

d) Related Courses

None

e) Course Outcomes

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Solve engineering problems using the principles of statics of particles	K2
CO2	Establish the magnitude of forces and moments acting on rigid bodies	K2
CO3	Define properties and theories related to surfaces and solids	K3
CO4	Solve engineering problems on basics of fluid mechanics and relate it to bio-fluids.	K3
CO5	Describe the principles of dynamics of particles and various types of friction.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3									1		1
CO2	3	1	3									1	1	1

CO3	3	1	3									1	1	1
CO4	3	1	3									1	1	1
CO5	3	1	3									1	1	1

f) Course Content

UNIT I BASICS & STATICS OF PARTICLES L-6 T-6

Introduction – Units and Dimensions – Laws of Mechanics – Lami’s theorem, Parallelogram and Triangular Law of forces – Vectors – Vectorial representation of forces and couples – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES L-6 T-6

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Scalar components of a moment – Varignon’s theorem – Equilibrium of Rigid bodies in two dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS L-6 T-6

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Second and product moments of plane area – Parallel axis theorem and perpendicular axis theorem

UNIT IV BASICS OF MECHANICS OF FLUIDS L-6 T-6

Fluids – density – pressure – blood pressure and gravity – buoyancy – moments of force and stability – movement in water – Newton’s laws of viscosity – Definitions and simple problems on Newtonian fluid, Non-Newtonian fluid.

UNIT V DYNAMICS OF PRACTICLES & FRICTION L-6 T-6

Frictional force – Laws of Coulomb friction – simple contact friction – Belt friction – Roller friction. Translation and Rotation of Rigid Bodies – General Plane motion.

Total:60 Hrs

g) Learning Resources

Text Books

- [1] R.S.Khurmi. *A Text Book of Engineering Mechanics*. S Chand and Company, 2019.
- [2] Dr. R. K. Bansal. *A Text Book of Fluid Mechanics*. Laxmi Publications, 2018.
- [3] Hibbeler, R.C. *Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics*. Pearson Education Asia, 2019.
- [4] S.Timoshenko, D.H.Young, J.V.Rao, Sukumar Pati. *Engineering Mechanics*, McGraw Hill, 2018.

Reference Books

- [1] Palanichamy, M. S., Nagan, S. *Engineering Mechanics (Statics and Dynamics)*. McGraw Hill, 2012.
- [2] Kumar, K. L. *Engineering Mechanics*. McGraw Hill, 2019.
- [3] Shames, I. H., Krishna Mohana Rao, G. *Engineering Mechanics (Statics and Dynamics)*. Pearson Education, 2019.
- [4] Beer, F. P., Johnston, E. R. *Vector Mechanics for Engineers – Dynamics and Statics*. McGraw Hill, 2011.
- [5] Natarajan K.V. *Engineering Mechanics*. Dhanalakshmi Publishers, 2011.
- [6] Lee Waite. *Bio fluid Mechanics in Cardiovascular Systems*ll. McGraw Hill, 2016.

Course Code	Course Title	L	T	P	C
10211BM105	Bio Sensors and Transducers	3	0	0	3

a) **Course Category**

Program core

b) **Preamble**

The student should be able to explain how physiological parameters are being measured.

c) **Prerequisite**

None

d) **Related Courses**

Bio Medical Instrumentation

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the principles of electrodes	K2
CO2	Explain the methods of pressure measurements	K2
CO3	Explain the methods of flow measurements	K2
CO4	Explain the methods of motion and force measurements	K2
CO5	Explain the methods of temperature measurements	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												2
CO2	3	1												2
CO3	3	1												2
CO4	3	1												2
CO5	3	1												2

f) **Course content**

UNIT I INTRODUCTION TO SENSORS AND TRANSDUCER

9

Transducer and Measurement system - Static Characteristics – Dynamic Characteristics – Standards and Calibration – Types of Error. Bioelectric and Biomagnetic Measurement: Bioelectric events, Biomagnetic events. Electrode theory – Electrode-Electrolyte interface – Liquid junction potentials – Double layer – Electrode potentials. Surface Potential Electrodes: ECG electrodes – EMG electrodes – ECG electrodes. Glass electrodes – Metal Electrodes – Suction electrodes. Bio Magnetism: Biomagnetic fields – Magnetopneumography.

UNIT II PRESSURE MEASUREMENTS

9

Requirements of pressure measurements, Direct pressure measurement: Catheters and diaphragm type pressure measurement – Catheter tip pressure transducer, Pressure measurement in small vessels - Servo controlled, Pressure measurement in collapsible vessels – Interstitial pressure measurement – Differential pressure measurement. Indirect pressure measurement – Systolic, Diastolic and Mean blood pressure – Auscultatory and Oscillometric method.

UNIT III FLOW MEASUREMENT

9

Requirements of flow measurement, Blood flow meters in single vessel – Electromagnetic flow meter – Ultrasound flow meter – Indicator dilution method. Tissue blood flow meter – Venous Occlusion plethysmography. Respiratory Gas flow measurements – Gas flow sensors - Lung plethysmography.

UNIT IV MOTION AND FORCE MEASUREMENTS

9

Objects of Measurements, Motion Measurements: Displacement and rotation measurements by contact transducers - Displacement and rotation measurements of body in extracted tissue – Displacement measurement in vivo, Non contact measurement of displacement and rotation. Force measurements: Muscle contraction measurement – Force measurements in isolated muscles – In vivo measurement of muscle contraction.

UNIT V TEMPERATURE MEASUREMENT

9

Requirements of temperature measurement, Temperature transducers – Thermistor - Thermocouple– Thin film thermo resistive element – p-n junction diodes and transistors. Clinical thermometers: Indwelling thermometer probes – Rectal, Esophageal and Bladder temperature measurement, Tympanic thermometer, Zero heat flow thermometer.

Total: 45 Hrs

g) Learning Resources

Text Books

[1] Tatsuo Togawa, Toshiyo Tamura, P. Ake Oberg. *Biomedical Transducers and Instruments*. CRC Press, 1997.

Reference Books

[1] Ernest O Doebelin, Dhanesh N Manik, *Measurement systems, Application and design*. McGraw Hill, 2007.

[2] Khandpur, Raghbir Singh. *Handbook of biomedical instrumentation*. McGraw-Hill Education, 2003.

[3] Leslie Cromwell. *Biomedical Instrumentation and measurement*. Prentice hall of India, 2007.

[4] John G. Webster. *Medical Instrumentation Application and Design*. John Wiley and sons, 2004.

[5] L.A Geddas, L.E.Baker. *Principles of Applied Biomedical Instrumentation*. John Wiley and Sons, 2008.

[6] Albert D.Helfrick, William D. Cooper. *Modern Electronic Instrumentation and Measurement Techniques*. Prentice Hall of India, 2007.

Course Code	Course Title	L	T	P	C
10211BM106	Control systems	3	2	0	4

a) **Course Category**

Program core

b) **Preamble**

This course will give comprehension of the essentials of control frameworks beginning from rudiments of control hypothesis to certain instances of biomedical designing applications

c) **Prerequisite**

Engineering Mathematics

d) **Related Courses**

Bio Mechanics, Signals and Systems

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Apply the mathematical concepts to model physiological systems & representing the systems with block diagrams and signal flow graphs.	K3
CO2	Plot and Interpret the time response of various systems and discuss the concept of system stability.	K3
CO3	Plot and Interpret the frequency response characteristics of various systems.	K3
CO4	Apply the concepts of controller design for the given specification.	K3
CO5	Model the human physiological systems.	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2	2				2					
CO2	3	2		2	2				2					
CO3	3	2		2	2				2					
CO4	3	2	2	2	2				2					
CO5	3	2	2	2	2				2					

f) Course Content

UNIT-1: INTRODUCTION

15 Hrs

Basic Control Definitions, Fundamental Control Concepts, Analysis and Design Objectives, Design Process, Reduction of block diagram and signal flow graph. Mathematical modelling of linear systems: Continuous Time-Linear Systems- Linear and Time Invariant Systems- Laplace Transform- Discrete-Time Linear Systems- Z-Transform- Continuous and Discrete Transfer Functions.

UNIT-II: TIME DOMAIN ANALYSIS OF CONTINUOUS & DISCRETE SYSTEMS

17 Hrs

Continuous Transient Response Analysis, First Order System Response, Second Order System Response: Second Order system with distinct real roots- Second order systems with repeated real roots- second order system with conjugate complex roots, System Identification: First order system identification- Second order system identification, Discrete Transient Response analysis, Mapping from S -plane to Z -plane, Continuous and Discrete systems stability.

UNIT-III: FREQUENCY DOMAIN ANALYSIS OF CONTINUOUS & DISCRETE SYSTEMS

17 Hrs

Frequency Response Analysis of Continuous systems, Bode Diagrams of Continuous systems, Frequency Response Analysis of Discrete-Time systems, Bode Diagrams of Discrete-Time Systems, Relation between Transient and Frequency Response, Relative stability of Continuous and Discrete Time systems in the frequency domain, Root locus Analysis of Continuous and Discrete Systems.

UNIT-IV: CONTROL SYSTEM DESIGN

13 Hrs

PID continuous controller: Proportional Control- Integral Control- Derivative Control, Discretization of Continuous Controller, Tuning PID Controllers, Ziegler-Nichols Technique in Open loop and Closed loop.

UNIT-V: APPLICATIONS IN THE FIELD OF BIOMEDICAL ENGINEERING 13 Hrs

Regulation of Cardiac Output: The cardiac output curve- The venous return curve- Closed loop Analysis: Heart and Systemic Circulation, Regulation of Insulin, Model of Cheyne-stokes Breathing.

Total hrs- 75

Text Books

[1] de Cañete, J. Fernández, C. Galindo, J. Barbancho, and A. Luque. *Automatic control systems in biomedical engineering*. Springer International Publishing, 2018.

[2] Michael C K Khoo. *Physiological Control Systems*. IEEE Press, Prentice Hall of India.

Reference Books

[1] Norman S. Nise. *Control Systems Engineering*. John Wiley & Sons.

[2] I.J. Nagarath, M. Gopal. *Control Systems Engineering*. Anshan Publishers.

[3] Ogata Katsuhika. *Modern Control Engineering*. Prentice Hall of India.

Course Code	Course Title	L	T	P	C
10211BM107	Microcontroller and Digital signal processor	2	2	0	3

a) **Course Category**

Program core

b) **Preamble**

Microcontrollers are the basic building blocks of all embedded systems and DSPs are the core of many multimedia devices existing today. This course gives primary knowledge required to design such devices. This course assumes no prior knowledge of DSP

c) **Prerequisite**

Digital Electronics

d) **Related Courses**

Digital Signal Processing, Image Processing

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Solve simple logics using 8085 ALP	K3
CO2	Describe the architecture of MSP430 and write c codes for simple applications with MSP430	K3
CO3	Implement a system which uses ADC with MSP430	K3
CO4	Compare the architecture of MSP430 and DSP	K3
CO5	Write simple programs with DSP peripheral hardware	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	1	3					1			2	2

CO2	2	2	1	1						1			2	2
CO3	3	2	3	1	3	2				1			3	3
CO4	2	3	2	3						1			2	2
CO5	3	2	3	1	3	2				1			3	3

f) Course Content

UNIT-I 8085 architecture and programming 12

Introduction to 8085 Architecture, Addressing Modes, Instruction Formats, and Instruction Set. Introduction to 8086 Architecture, Features, Signals, I/O & Memory Interfacing, Addressing Modes, Instruction Formats, Instruction Set, Assembler Directives, Interrupts, Minimum Mode & Maximum Mode Operation,

UNIT-II TI MSP430 Launchpad and programming 14

General Layout, CPU, Memory, I/O ports, clock, timer and watchdog timer module, ADC and comparator module, other module, interrupts, interrupt vectors, port interrupts, ISR, Introduction, addressing modes, stack, simple programs, Digital I/O Registers, coding practices for digital I/O

UNIT-III Mixed signal system 10

Analog and digital signals, the comparator, A/D conversion, D/A conversion, ADC 10 and application

UNIT-IV DSP Architecture and Programming 12

Architecture and Memory organization, addressing modes, instruction set, assembler directives, Programming Examples Using C code

UNIT-V DSP 12

The analog interface circuit, interrupts and peripherals, External/Flash Memory and I/O with 16-bit Stereo Audio Codec, Programming Examples Using C code

Total: **60 Hrs**

Learning Resources

Text Books

- [1] Ramesh S Gaonkar. *Microprocessor Architecture, Programming and application with 8085*. Penram International Publishing.
- [2] P. Lapsley, J. Bier, A. Shoham, E.A. Lee. *DSP Processor Fundamentals - Architectures and Features*. IEEE Press, 1997.
- [3] K. Hintz, D. Tabak. *Microcontrollers - Architecture, Implementation and Programming*. McGraw Hill, 1992.

Reference Books

- [1] Brey, Barry B. *The Intel microprocessors: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit extensions: architecture, programming, and interfacing*. Pearson Education India, 2009.
- [2] Fernandez, Adrian, and Dung Dang. *Getting started with the MSP430 launchpad*. Newnes, 2013

Web Resources

1. https://www.ti.com/lit/ug/slau318g/slau318g.pdf?ts=1624954174860&ref_url=https%253A%252F%252Fwww.google.com%252F
2. <http://embeddedtechnosolutions.com/wp-content/uploads/2016/11/MSP430-Tutorial.pdf>

Course Code	Course Title	L	T	P	C
10211BM108	Digital Signal Processing	2	2	0	3

a) Course Category

Program core

b) Preamble

This course provides the basic knowledge on the required mathematics for the process of analog and digital signals

c) Prerequisite

Transforms and Partial differential Equations

d) Related Courses

Microprocessor and Microcontroller, Image Processing

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Classify the continuous/discrete time signals/systems from the given equation according to their properties	K3
CO2	1. Compute the spectrum of periodic and aperiodic signals using continuous and Discrete Fourier transform. 2. Analyze the given Discrete system using Z-transform.	K3
CO3	Solve problems on analog to digital signal conversion, Aliasing and identify the signal using Fourier transform	K3
CO4	Design FIR filter for the given specification	K3
CO5	Design IIR filter for the given specification	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1							1		1
CO2	2	1	1	1	1							1		1

CO3	2	2	1	1	2							1		1
CO4	2	2	1	1	2							1		1
CO5	2	2	1	1	2							1		1

UNIT-I Classification of signals and systems

12

Continuous Time signals (CT signals) – Discrete Time signals (DT signals) – Elementary CT signals and DT signals – Basic properties of signals , Classification of CT and DT signals – Basic properties of systems – Classification CT systems and DT systems – Linear time invariant systems and properties

UNIT-II Signal and system analysis (CT and DT)

12

Fourier Transform in signal analysis and system analysis, convolution integral and impulse response, Fourier transform of discrete sequence, Z-transform and its properties, inverse z-transforms; Stability analysis, frequency response – Convolution..

UNIT-III Representation of discrete time signals and FFT

12

Sampling of Continuous Time signals and aliasing –z transform in Discrete Time signal analysis, Discrete Fourier Transform, (DFT), DFT for periodic sequence, Fast Fourier Transform (FFT), Butterfly Diagram, Convolution through FFT

UNIT-IV Design of FIR Filters

12

FIR design: Windowing Techniques - Rectangular, Hamming, Hanning – Need and choice of windows – Linear phase characteristics.

UNIT-V Design of IIR Filters

12

IIR design: Analog filter design - Butterworth filter design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation..

Total: 60 Hrs

Learning Resources

[1] Haykin. *Signals and Systems*. Khanna Publishers, 2000.

[2] Proakis, J. G. and Manolakis, D. G. *Digital Signal Processing Principles, Algorithms and Applications*. Pearson Education India, 2003.

Reference Books

[1] Ashok Ambardar. *Analog and Digital Signal Processing*. Thomson Learning Inc., 1999.

[2] Douglas K.Lindner. *Signals and Systems*. McGraw Hill, 1999.

[3] Mithrs S.K. *Digital Signal Processing –A Computer Based Approach*. McGraw Hill, 2001.

[4] Oppenheim, Alan V. *Signals and Systems: An Introduction to Analog and Digital Signal Processing*. MIT Center for Advanced Engineering Study, 1987.

Course Code	Course Title	L	T	P	C
10211BM109	BIOMATERIALS	3	0	0	3

a) **Course Category**

Program core

b) **Preamble**

Knowledge on different biomaterials is essential for a biomedical engineer in order to make any biomedical products such as implants. This course gives an introductory knowledge about biomaterials, types, and its properties

c) **Prerequisite**

Physics or material science

d) **Related Courses**

Introduction to Nanotechnology

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the basic criteria, classification, properties and biocompatibility of the biomaterials	K2
CO2	Understand about diverse metallic biomaterials and their basic structure for biomedical use.	K2
CO3	Understand about different polymeric biomaterials and their basic composition for use in biomedical applications.	K2
CO4	Understand about various ceramic biomaterials and their basic structure for biomedical applications.	K2
CO5	Understand about different composite biomaterials and their structure for biomedical use.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3			1		1				1		3

CO2	1	2	3			1		1				1		3
CO3	1	2	3			1		1				1		3
CO4	1	2	3			1		1				1		3
CO5	1	2	3			1		1				1		3

f) Course content

Unit 1 Biomaterials – Introduction, Properties and Biocompatibility 10H

Introduction to Biomaterials, Basic Criteria for Biomaterials, Classification of Biomaterials, Selection and Performance of Biomaterials, Biological Responses - Surface and Physical Properties, Mechanical Properties, Stress-Strain Behaviour & Hardness, Mechanical Failures, Fatigue, Electrical, Optical and Magnetic Properties - Introduction To Biocompatibility, Blood Compatibility and Tissue Compatibility, and Rejections.

Unit 2 Metallic Biomaterials 8H

Stainless Steels, Cobalt (Co)-Chromium (Cr) Alloys, Titanium (Ti) Alloys, Corrosion of Metallic Implants – Stress and Cracking. Hard Tissue Replacement Materials: Orthopaedic Implants and Dental Implants. Soft Tissue Replacement Materials: Percutaneous and Skin Implants, Vascular Implants, and Heart Valve Implants.

Unit 3 Polymeric Biomaterials 9H

Polymerization and basic structure, Polymeric biomaterials: Polyolefin (Polyethylene (PE), Polypropylene (PP)), polyamides (Nylon), acrylic polymers (Polymethylmetacrylate (PMMA)), fluorocarbon polymers (Polytetrafluoroethylene (PTFE)), Silicone Rubber, Hydrogels, Biodegradable Polymers - Classification according to Thermosets, Thermoplastics (Polyetherether ketone (PEEK)) and Elastomers. Natural bio-polymers: Collagen, Elastin and chitin. Biomedical Applications.

Unit 4 Ceramic Biomaterials 8H

Definition of Bioceramics - Non-absorbable materials: Alumina, Carbons, Zirconia. Biodegradable Ceramics: Calcium phosphate, Aluminum-Calcium-Phosphate (ALCAP) Ceramics. Bioactive ceramics: Glass ceramics and Hydroxyapatite. Biomedical applications.

Unit 5 Composite Biomaterials & Sterilization in Biomaterials 10H

Properties and Types of Composites - Mechanics of Improvement of properties by incorporating different elements - Composite Theory of Fibre reinforcement (short and long fibres, fibres pull out) - Polymers Filled with Osteogenic Fillers (e.g. Hydroxyapatite). Biomedical applications.

Sterilization procedures: ETO, gamma radiation, autoclaving, Effects of sterilization on material properties.

Total: 45 Hrs

g. Learning Resources

Text Books

- [1] Sujata V. Bhat. *Biomaterials*. Narosa Publishing House, 2005.
- [2] Bronzino, Joseph D. *Biomedical Engineering Handbook 2*. Vol. 2. Springer Science & Business Media, 2000.
- [3] Sreeram Ramakrishna. *Biomaterials: A Nano Approach*. CRC Press, 2010.
- [4] Wagner, William R., Shelly E. Sakiyama-Elbert, Guigen Zhang, and Michael J. Yaszemski, eds. *Biomaterials science: An introduction to materials in medicine*. Academic Press, 2020.

Reference Books

- [1] Black, Jonathan. *Biological performance of materials: fundamentals of biocompatibility*. Crc Press, 2005.
- [2] Szycher, Michael, and Chandra P. Sharma. *Blood compatible materials and devices: Perspectives towards the 21st century*. CRC Press, 1990.
- [3] Piskin, E. "Biologically modified polymeric biomaterial surfaces: introduction." In *Biologically Modified Polymeric Biomaterial Surfaces*, pp. 3-7. Springer, Dordrecht, 1992.
- [4] Jenkins, Mike, ed. *Biomedical polymers*. Elsevier, 2007.

Course Code	Course Title	L	T	P	C
10211BM110	Bio Medical Instrumentation	3	0	0	3

a) Course Category

Program core

b) Preamble

To make the student to acquire knowledge on how to record and measure bio signals and to design bio amplifiers.

c) Prerequisite

Analog Electronics and Integrated Circuits

d) Related Courses

Bio transducers and sensors.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Compare the different types of electrodes and draw its equivalent circuit.	K2
CO2	Explain how record the various bio signals.	K2
CO3	Design amplifiers used for measuring biosignals.	K3
CO4	Explain the importance of Bio safety	K2
CO5	Explain the Bio chemical measurements	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1											2	2
CO2	3	1											2	2

CO3	3	2	1	2									2	2
CO4	3	1											2	2
CO5	3	1											2	2

f) Course content

UNIT I BIO POTENTIAL ELECTRODES 9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.

UNIT II BIO SIGNAL RECORDING 10

ECG: origin, waveforms and their characteristics, Einthoven triangle, lead configurations, electrocardiograph, 12 lead ECG machine circuit, common mode and interference reduction circuits, Vector cardiograph, Recording of EMG, EEG : origin, waveforms and their characteristics, 10-20 electrode placement system, Electro encephalogram, Magneto encephalogram, EOG & ERG: origin, measurement of EOG, electroretinogram, Heart sounds: origin, phonocardiography.

UNIT III BIO AMPLIFIERS 9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference.

UNIT IV BIO ANALITICAL EQUIPMENTS AND PATIENT SAFETY 10

Blood cell counters –microscopic method, automatic optical, method, coulter counter,automatic recognition and differential counting of cells, flow cytometer, Selective ion electrodes, ion analyzer, Electric shock hazards, micro current shock, leakage currents, Precautions to minimize electric hazards, safety codes for electro medical equipment, electrical safety analyzer.

UNIT V BIO CHEMICAL MEASUREMENTS 7

pH, pco₂, po₂, - colorimeter, spectrophotometer, flame photometer. Autoanalyser

Total:45 Hrs.

g) Learning Resources

Text Books

[1] Webster, John G., ed. *Medical instrumentation: application and design*. John Wiley & Sons, 2009.

[2] Khandpur, Raghbir Singh. *Handbook of biomedical instrumentation*. McGraw-Hill Education, 2014.

Reference Books

[1] Cromwell, Leslie, Fred J. Weibell, Erich A. Pfeiffer, and Leo B. Usselman. *Biomedical instrumentation and measurements*. Prentice-Hall, Inc., 2007.

[2] Myer Kutz. *Standard Handbook of Biomedical Engineering and Design*. McGraw Hill, 2003.

[3] Joseph J. Carr, John M. Brown. *Introduction to Biomedical Equipment Technology*. Pearson Education, 2004.

Course Code	Course Title	L	T	P	C
10211BM111	Diagnostic and Therapeutic Equipments	3	0	0	3

a) Course Category

Program core

b) Preamble

This course deals with the medical devices used for the measurement of biological parameters and the methods of continuous monitoring and treating them

c) Prerequisite

None

d) Related Courses

Bio medical Instrumentation and Radiological Equipments.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Study and discover the concept of Respiratory measurements.	K3
CO2	Explain the concept about Assist devices and their applications	K2
CO3	Correlate the concept of diathermy and their application	K4
CO4	Illustrate the importance of ultrasonic technique and Drug delivery systems.	K2
CO5	Summarize the importance of Extra corporeal devices	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1		2	2	1	1			2	2	2
CO2	3	1	2	1		2	2	1	1			2	2	2
CO3	3	1	2	1		2	2	1	1			2	2	2
CO4	3	1	2	1		2	2	1	1			2	2	2
CO5	3	1	2	1		2	2	1	1			2	2	2

f) Course content

UNIT I RESPIRATORY MEASUREMENT SYSTEM

8

Artificial ventilation, ventilators-types of ventilators, pressure-volume-flow diagrams, modern ventilators , humidifiers, nebulizers and aspirators. Pulmonary function measurements - spirometry, pulmonary function analysers, Anaesthesia- Need for anaesthesia, anaesthesia machine

UNIT II ASSIST DEVICES

11

Common tests – audiograms, air conduction, bone conduction, masking techniques, Pure tone, Speech, Evoked response audiometry, Hearing aids – principles, DSP based hearing aids.

Cardiac Pacemaker- Internal and External Pacemaker, Pacemaker Standard Codes, AC and DC Defibrillator ,Cardiotocograph-Methods of Monitoring Foetal Heart Rate, Monitoring Labour Activity, Recording System. Intra-aortic ballon pump.

UNIT III DIATHERMY & STIMULATORS

9

Principle of Surgical diathermy-surgical diathermy machine, short wave diathermy, micro wave diathermy, ultrasonic therapy unit, High frequency heat therapy, Electrodiagnostic apparatus, pain relief through electrical stimulation bladder stimulators, cerebellar stimulators. Functional Electrical Stimulation, FES system controlled by EMG signal.

UNIT IV ULTRASONIC TECHNIQUE & DRUG DELIVERY SYSTEMS 8

Diagnostic Ultrasound, physics of ultrasonic waves, medical ultrasound, basic pulse-echo apparatus, A- Scan, Echocardiograph (M-Mode), B- Scanner, Biological effects of ultrasound, Real time ultrasonic imaging systems. Infusion Pumps, Components of Drugs Infusion Systems, Implantable Infusion Systems.

UNIT V EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC EQUIPMENTS 9

Haemodialysis Machines- Function of Kidneys, Artificial Kidney, Dialyzers, Membranes for Haemodialysis, Haemodialysis machine, Portable kidney machines. Lithotriptors- Introduction, First lithotripter machine, Modern Lithotripter System. Heart-lung machine, Oxygenator.

Total:45 Hrs.

g) Learning Resources

Text Books

[1] R. S. Khandpur. *Handbook of Bio-Medical Instrumentation*. 3rd Edition, McGraw Hill Education (India) Private Limited, 2014.

[2] Anthony Y. K. Chan. *Biomedical Device Technology: Principles and Design*. 1st Edition, Charles C Thomas Publisher Ltd, 2008.

Reference Books

[1] R. S. Khandpur. *Compendium of Biomedical Instrumentation*. 1st Edition, John Wiley & Sons Ltd, 2020.

[2] Joseph J. Carr, John M. Brown. *Introduction to Biomedical Equipment Technology*. 4th Edition, 2008

[3] Bronzino, Joseph D. *Biomedical Engineering Handbook 2*. Vol. 2. Springer Science & Business Media, 2000.

Course Code	Course Title	L	T	P	C
10211BM112	Radiological Equipments	3	0	0	3

a) **Course Category**

Program core

b) **Preamble**

The course gives the basic knowledge on how radiological equipment are used for measuring physiological parameters and what are the safety measures need to be followed

c) **Prerequisite**

Basic Physics

d) **Related Courses**

Bio Sensors and Transducers, Bio-Medical Instrumentation

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the production of X rays and its various components	K2
CO2	Explain how X rays are used for sectional imaging.	K3
CO3	Explain the underlying principles of NMR and its components.	K2
CO4	Describe the application of radionuclides in medical field	K2
CO5	Explain how body heat can be used as a diagnostic tool	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		1	3		1		1		2		
CO2	3	2	1		1	3		1		1		2		
CO3	3	2	1		1	2		1		1		2		
CO4	3	2	1		1	2		1		1		2	1	
CO5	3	2	1		1	2		1		1		2		1

f) Course content

UNIT I DIAGNOSTIC X RAYS 9

Production of X-Rays – X-ray tubes, Visualization of x-rays – Fluorescent screen, Image intensifiers – construction and working principle. Digital radiography

UNIT II X-RAY COMPUTED TOMOGRAPHY 9

Principles of sectional imaging – scanner configurations, line integrals, projection sets. Image reconstruction techniques – overview of back projection and iteration methods

UNIT III MAGNETIC RESONANCE IMAGING 9

Principles of MRI – interaction of nuclei and static magnetic field and radio frequency wave, rotation and precession, induction of magnetic resonance signal, bulk magnetization. Components of MRI – Magnets, magnetic field gradients, RF system, transmit and receive coils, receiver and detection system.

UNIT IV NUCLEAR MEDICINE 9

Types of radioactive decay, Radiation detectors – gas detectors, Scintillation detectors, Semiconductor detectors. Gamma camera – principle of operation, Radiopharmaceuticals, Principles of PET and SPECT.

UNIT V THERMOGRAPHY 9

IR imaging system – pyroelectric imaging system, temperature measurement. Clinical thermography – physiological factors, applications.

Total: 45 Hrs.

g) Learning Resources

Text Books

[1] Steve webb. *The Physics of Medical Imaging*. Adam Hilger, Philadelphia, 1988.

Reference Books

[1] Gopal B. Saha. *Physics and Radiobiology of Nuclear Medicine*. Third edition, Springer, 2006.

[2] B.H.Brown, PV Lawford, R H Small wood, D R Hose, D C Barber. *Medical physics and biomedical Engineering*. CRC Press, 1999.

[3] Myer Kutz. *Standard handbook of Biomedical Engineering and design*. McGraw Hill, 2003.

[4] P.Ragunathan. *Magnetic Resonance Imaging and Spectroscopy in Medicine*. Orient Blackswan Pvt Ltd, 2007

Course Code	Course Title	L	T	P	C
10211BM201	Pathology and Microbiology	2	0	2	3

a) **Course Category**

Program core/Integrated

b) **Preamble**

To make the student to acquire knowledge on the structural and functional aspects of living organisms and to know the etiology and remedy in treating the pathological diseases

c) **Prerequisite**

Biology for Engineers

d) **Related Courses**

Biochemistry and Anatomy and Human Physiology.

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the structural and functional aspects of living organisms.	K2
CO2	Discuss the importance of public health.	K2
CO3	Explain the function of the microscope	K2
CO4	Explain the growth of microorganisms	K2
CO5	Identify methods involved in treating the pathological diseases	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			3	2			2				2		
CO2			2											
CO3		2		3	3	1	2							
CO4		3	2	3		1				3				
CO5	2			3						3				

f) Course content

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA 6

Cell injury and Necrosis, Apoptosis, Pathological calcification, cellular adaptations of growth and differentiation, Inflammation and fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours. Autopsy and biopsy.

UNIT II FLUID AND HEMODYNAMIC DERRANGEMENT 6

Edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders-Bleeding disorders, Leukaemias

UNIT III MICROSCOPES 6

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM & SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining.

UNIT IV MICROBIAL CULTURES 6

Morphological features and structural organization of bacteria, growth curve, identification of bacteria, culture media and its types , culture techniques and observation of culture.

UNIT V IMMUNOLOGY 6

Natural and artificial immunity, opsonization, phagocytosis, Immune deficiency syndrome, antibodies and its types, immunological techniques: immune diffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies. Disease caused by bacteria, fungi, protozoa, virus and helminthes

30 Hrs.

LIST OF EXPERIMENTS:

30 Hrs.

1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Basic staining – Hematoxylin and eosin staining.
3. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS.
4. Simple stain.
5. Gram stain.
6. Bleeding time and clotting time.
7. Slides of malarial parasites, micro filaria and leishmania donovani.
8. Haematology slides of anemia and leukemia.

Total: 60 Hrs.

g) Learning Resources

Text Books

[1] Ramzi S Cotran, Vinay Kumar & Stanley L Robbins. *Pathologic Basis of Diseases*. 7th edition, WB Saunders Co., 2005.

[2] Prescott, Harley and Klein. *Microbiology*. 5th edition, McGraw Hill, 2002.

Reference Books

[1] Underwood J. C. E. *General and Systematic Pathology*. Churchill Livingstone, 3rd edition, 2000.

[2] Anthanarayanan & Panicker. *Microbiology*. Orientblackswan, 2005.

[3] Dubey R. C. and Maheswari D.K. *A Text Book of Microbiology*. Chand & Company Ltd, 2007.

Course Code	Course Title	L	T	P	C
10211BM202	Artificial Neural Networks	3	0	2	4

a) **Course Category**

Program core/Integrated

b) **Preamble**

This course gives an introduction on classification using neural networks which is used in most biomedical applications.

c) **Prerequisite**

None

d) **Related Courses**

Brain Computer Interface, Image processing, Signal processing

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Represent given data in a neural network structure, and achieve the target by manual weight and bias updation	K2
CO2	Explain learning rules for neural nets and Construct the Competitive Neural Nets.	K3
CO3	Apply the Neural Nets for Pattern Classification.	K3
CO4	Achieve a target using back propagation network.	K3
CO5	Explain Other Networks and Illustrate applications of Neural Networks	K4

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	1				3		2	3	1
CO2	3	2	3	2	3	1				2		2	3	1
CO3	3	2	3	2	3	1				2		2	3	2
CO4	2	1	3	2	3	1				2		2	2	2
CO5	2	2	3	2	3	1				2		2	3	1

f) Course content

UNIT I MODELS, FEEDBACKS AND ARCHITECTURE

9

Introduction to neural network-brain, benefits of neural net, Elementary Neurophysiology and Model of neuron, neural networks as directed graphs, Network architecture – Single layer feed forward, multi-layer feed forward. Common activation functions, McCulloch Pitts neuron with examples – Logic gates.

UNIT II LEARNING PROCESS AND COMPETITIVE NEURAL NETWORK

9

Basic learning rules – Introduction, Error correction – delta rule, memory based, Hebbian – supervised and unsupervised rule, Competitive Neural Network-Kohonen Self organizing map, Learning Vector Quantisation

UNIT III SIMPLE NEURAL NETS FOR PATTERN CLASSIFICATION

9

Adaptive filtering problem, Perceptron-Architecture, Algorithm, Application ,Perceptron Convergence Theorem, Adaline- Architecture, Algorithm, Applications, Madaline

UNIT IV BACK PROPOGATION NETWORK AND ASSOCIATIVE MEMORY

9

Back propagation Network, generalized delta rule, Bidirectional Associative memory, Hopfield Network

UNIT V OTHER NETWORKS AND APPLICATIONS

9

Radial basis function network, K-means clustering, Adaptive Resonant Theory (ART), Counter Propagation network, Applications of ANN in biomedical signal analysis and medical image analysis

45 Hrs.

LIST OF EXPERIMENTS

30 Hrs.

1. Study of important functions of Python
2. Generation of Activation Functions
3. Mu-Culloch Pitts Neuron Simulation
4. Implementation of Logic gates using Hebb Learning rule
5. Training a network using Perceptron Learning rule.
6. Implementation of Gradient Descent algorithm
7. Implementation of ADALINE
8. Adaptive noise filtration using LMS algorithm
9. Backpropagation
10. K – means clustering

Total: 75 Hrs.

g) Learning Resources

Text Books

[1] Laurene Fausett. *Fundamentals of neural networks- Architectures, algorithms and applications*. Prentice Hall, 1994

Reference Books

[1] Simon Haykins. *Neural Networks – A comprehensive foundation*. 2nd Edition, Pearson Publications, 2009.

[2] Hagan, Demuth and Beale. *Neural network design*. Vikas Publishing House Pvt Ltd., New Delhi, 2002.

[3] Freeman J.A., and Skapura B.M. *Neural Networks, Algorithms, Applications and Programming Techniques*. Addison Wesley, 2003.

[4] Laurene Fausett. *Fundamentals of neural networks- Architectures, algorithms and applications*. Prentice Hall, 1994

Web sources/videos:

[1] Accessed on: 20 March 2020. Available on: <https://in.mathworks.com/>

[2] Accessed on: 23 March 2020. Available on <https://towardsdatascience.com/>

[3] Accessed on: 18 March 2020. Available on <https://becominghuman.ai/>

Course Code	Course Title	L	T	P	C
10211BM203	Biomechanics	2	0	2	3

a) **Course Category**

Program core/Integrated

b) **Preamble**

This course provides an introduction to the basic concepts of mechanics of physiological systems, laws of fluid dynamics that are applicable in human body and use of mechanics in medicine. To discover and also predict the mechanics of human bones, joints, orthopedic and cardiovascular implants.

c) **Prerequisite**

Engineering Mechanics

d) **Related Courses**

None

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the importance of biomechanics in medicine	K2
CO2	Illustrate the laws of fluid dynamic in biological fluid and mechanics of skeletal system	K3
CO3	Summarize the Muscular consideration for movement	K2
CO4	Discuss the functional anatomy for lower and upper Extermity	K2
CO5	Demonstrate the models specific to orthopedic applications.	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3		3	3			1	3			
CO2	3	3								3	2	2		
CO3	3	2	3			1								
CO4	3		2			1	1					3		
CO5	3	3	3					3	1	3				1

f) Course content

UNIT I Introduction to BioMechanics

6hrs

Biomechanics, Scope of mechanics in medicine, Anatomy vs Functional Anatomy, Mechanical loads of the human body, Effects of loading, Movement Description - Basic movements - Specialised movement descriptors, Anatomical movements

UNIT II MECHANICS OF PHYSIOLOGICAL SYSTEM

6hrs

Biomechanical characteristics of Bone, Bone modeling and Remodeling - strength and stiffness of bone, Biomechanics of joints, Mechanical properties of Joints, Kinematics and kinetics of joints, Biomechanics of cartilage and cartilage failure, Mechanical properties of cartilage

UNIT III BIOMECHANICS OF SKELETAL MUSCLE:

6hrs

Structure of an individual muscle fibre, Types of muscle; Force generation in the muscle - Motor unit, Muscle Contraction, Mechanical Model of muscle - The musculo tendinous unit, Skeletal muscles servo mechanism.

UNIT IV FUNCTIONAL ANATOMY FOR LOWER AND UPPER EXTERMITY 6hrs

Lower Extermity: Structure of Hip joints - Muscular action of Hip - Loads on the Hip - Structure of Knee Joint - Combined movements of Ankle and foot

Upper Extermity: Shoulder complex- The elbow and radioulnar joints - The wrist and fingers, Movement Characteristics of the Elbow, Loads on the elbow, common injuries of upper Extermity

UNIT V GAIT ANALYSIS AND ORTHOPAEDIC APPLICATIONS 6hrs

Dynamics and analysis of human locomotion - Gait analysis (determination of instantaneous joint reaction analysis), occupant response to vehicular vibration. Mechanics of knee joint during standing and walking

Total: 30 Hrs

LIST OF EXPERIMENTS 30 Hrs.

1. Determine the muscle strain by using dynamometer.
2. To study of neurological functions by using pinchmeter.
3. To measure the ground reaction forces generated by a body standing on, walking or moving across them by using force plates.
4. Determination of muscle elasticity using myometer.
5. Strength determination of using hand load cells.
6. Analysis the posture of feet in static and moving as well as behaviour of knees, hips and joints.

Total: 60 Hrs.

h) Learning Resources

[1] Joseph Hamill, Kathleen M. Knutzen, Timothy R. Derrick. *Biomechanical Basis of Human-Movement*. 4th Edition, Wolters Kluwer, 2018.

[2] Duane K. *Fundamentals of Biomechanics*. Springer, 2020.

[3] Susan J.Hall. *Basics Bio Mechanics*. 5th Edition, McGraw-Hill Publishing Co, USA, 2014

[5] Joseph D.Bronzino. *Biomedical Engineering Fundamentals*. Taylor & Francis, 2006.

[6] Peter M. McGinnis. *Biomechanics of sports and exercise*. Human kinetics, 3rd Edition, 2013.

Course Code	Course Title	L	T	P	C
10211BM204	Image Processing	3	0	2	4

a) Course Category

Program core/Integrated

b) Preamble

To make the student to acquire knowledge on how images are processed digitally

c) Prerequisite

Signals and Systems.

d) Related Courses

Medical imaging, Digital signal processing.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Infer how an image is acquired and how pixels are related with each other	K2
CO2	Explain how image enhancement is done both in Spatial and frequency domains	K2
CO3	Compare the different noise models applicable to image processing and discuss the various restoration methods and segmentation techniques.	K2
CO4	Compare and explain the theory behind lossy and lossless image coding techniques under predictive and transform coding techniques	K2
CO5	Classify the methods for representation and descriptors of the images	K2
CO6	Apply MATLAB coding for basic image processing utilities	K3

CO7	Experiment with MATLAB coding for applications of transform such as filtering	K3
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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2								1		1
CO2	3	1	2	2				1				1		1
CO3	3	1	2	2		1		1				1		1
CO4	3	1	2	2		1		1				1		1
CO5	3	1	2	2								1		1
CO6	1		3	3	3				1	1		2		1
CO7	1		3	3	3				1	1		2		1

f) Course content

UNIT I FUNDAMENTALS OF DIGITAL IMAGING

9

Introduction – Origin – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – overview of mathematical tools

UNIT II IMAGE ENHANCEMENT

9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering – Smoothing and Sharpening Spatial Filtering

Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters..

UNIT III IMAGE RESTORATION AND IMAGE SEGMENTATION

9

Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

Segmentation: Point detection – Line detection – Edge models and edge detection – Edge Linking and Boundary detection.

UNIT IV WAVELETS AND IMAGE COMPRESSION **9**

Wavelets – Subband coding - Multiresolution expansions.

Compression: Fundamentals – Image Compression models – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards – JPEG, JPEG 2000

UNIT V IMAGE REPRESENTATION AND RECOGNITION **9**

Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments. Boundary description – Shape number – Fourier Descriptor, moments- Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

45 Hrs

LIST OF EXPERIMENTS:

30 Hrs.

1. Conversion between color spaces.
2. Histogram Equalization.
3. Filtering Technique.
4. Edge detection using Operators.
5. Wavelet Decomposition.
6. Image Compression.
7. Image Segmentation
8. Mini Project (Any Application).

Total: 75 Hrs.

g) Learning Resources

Text Books

[1] Rafael C. Gonzales, Richard E. Woods. *Digital Image Processing*. Third Edition, Pearson Education, 2010.

Reference Books

[1] Anil Jain K. *Fundamentals of Digital Image Processing*. PHI Learning Pvt. Ltd., 2011.

[2] William K Pratt. *Digital Image Processing*. John Willey, 2002.

[3] Malay K. Pakhira. *Digital Image Processing and Pattern Recognition*. First Edition, PHI Learning Pvt. Ltd., 2011.

Course Code	Course Title	L	T	P	C
10211BM301	Biochemistry and Physiology Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

Biomedical engineering deals with human physiological parameters. This course gives a hands on for understanding and quantifying the physiological parameters

c) Prerequisite

None

d) Related Courses

Bio Chemistry / Anatomy and Human Physiology

e) Course Outcomes

Upon successful completion of the course students will be able to

CO. Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Measure physiological parameters to make a primary assessment of the subject	S2
2	Analyze a given sample	S2
3	Quantify the macromolecules present in a sample	S3
4	Demonstrate dissection to show important anatomical parts	S1

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1		2		2						2		2
CO2	3	2		2	2	2						2		2
CO3	3	2		2	2	2						2		2

CO4	3	1		1	1	2						1		1
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LIST OF EXPERIMENTS

1. Blood Pressure Measurement
2. Hearing loss test
3. Blood grouping test
4. Bleeding and Clotting test
5. Qualitative Tests For Carbohydrates
6. Quantitative Tests For Carbohydrates
7. Qualitative analysis of proteins
8. Quantitative analysis of proteins
9. Separation of amino acids
10. Virtual dissection of arteries and vein
11. Virtual dissection to locate joints
12. Visual test

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10211BM302	Analog and Digital Integrated Circuits Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

Biomedical engineering deals with designing of medical devices. This course gives a hands on for designing the amplifier and digital circuits for medical devices

c) Prerequisite

Basic Electronics Engineering.

d) Related Courses

Sensors and Transducers, Circuit Theory, Digital Electronics, AEIC

e) Course Outcomes

Upon successful completion of the course students will be able to

CO. Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Design and demonstrate the basic amplifier circuit	S3
2	Design and demonstrate the application of OP amp	S3
3	Design and demonstrate the working of multivibrator	S3
4	Design and demonstrate the combinational circuits using gates	S3
5	Design and demonstrate the sequential circuits	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	2								2	
CO2	2	2	3	3	2								3	
CO3	2	1	3	2	2								3	

CO4	3	3	3	2	2									1	
CO5	3	3	3	2	2									1	

LIST OF EXPERIMENTS

1. Design and Analysis of Common Emitter (CE) Amplifier.
2. Design a differential amplifier using IC 741.
3. Design a Non-Inverting and Inverting Amplifiers using op-amp.
4. Design an Integrator and Differentiator using op-amp.
5. Design a RC oscillator for a desired frequency using op-amp.
6. Design a Colpitts oscillator using op-amp.
7. Multivibrators using IC 555 Timer.
8. Design a Schmitt Trigger using op-amp IC 741.
9. Design and implementation of combinational circuits using basic gates and universal gates for arbitrary functions.
10. Design and implementation of Code converters.
11. Design and implementation of multiplexers and Demultiplexers.
12. Design and implementation of synchronous counters and Asynchronous Counters.
13. Design of Digital to Analog and Analog to Digital Converters

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10211BM303	Sensors and Transducers Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

This course gives hands on experience on working with sensors

c) Prerequisite

Analog and Digital Circuits

d) Related Courses

Biomedical Instrumentation

e) Course Outcomes

Upon successful completion of the course students will be able to

CO.Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Measure the characteristics of different sensors	S1
2	Acquire and measure various physiological parameters with an appropriate sensor.	S2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	2	1		2	1			2	1	2
CO2	1	2	2	2	2	1		2	1			2	1	2

LIST OF EXPERIMENTS

1. Measurement of static characteristics of sensor
2. Study of thermistor characteristics for temperature measurements
3. Measurement of strain gauge characteristics
4. Fiber optic sensor for temperature measurements
5. Fiber optic sensor for force measurements
6. Design of electronics for ECG signal acquisition

7. Study of bioelectrode design and biosignal acquisition
8. Design of electronics for respiration rate measurements
9. Measurement of lung capacity using lung plethysmography
10. Study of the working principle of photodiodes and optoelectronics

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10211BM304	Microcontrollers and DSP Processor Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

Biomedical engineering deals with microprocessors and microcontroller for designing medical devices. This course gives hands-on for programing microprocessors and microcontrollers.

c) Prerequisite

Analog and Digital Circuits

d) Related Courses

Digital Signal Processing

e) Course Outcomes

Upon successful completion of the course students will be able to

CO.Nos	Course outcome	Skill Level (Dave'sTaxonomy)
1	Write assembly language programming (ALP) for addressing modes of 8085, 8051	S2
2	Write ALP for various arithmetic logic operations of 8085 and simple interfaces with 8051	S2
3	Design and demonstrate sensor interfacing with MSP430 microcontrollers	S3
4	Demonstrate simple interfaces with MSP430	S2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			2								2	
CO2	2	2			2								2	

CO3	1	1	2	3	3	2	2						1	3
CO4	1	1	2	3	3	2	2						1	3

LIST OF EXPERIMENTS

1. Demonstration of addressing modes of 8085.
2. Addition of two 8 bit and 16-bit number using 8085 Microprocessor.
3. Multiplication and Division of 8-bit number using 8085.
4. Configure timer for signal generation with given frequency using 8051 Microcontroller.
5. Interfacing of Seven Segment Display with 8051 Microcontroller.
6. Interface push button switch and flash LED's with MSP430 Microcontroller.
7. GPIO Interrupts programming with MSP430 Microcontroller.
8. Configure watchdog timer in watchdog mode & interval mode.
9. Read body temperature using MSP430 with the help of inbuilt ADC.
10. Use analog comparator to compare the signal threshold level.
11. Serial Communication between MSP430 Launchpad and PC.
12. Master slave communication between MSPs using SPI protocol.

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10211BM305	Digital Signal Processing Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

Biomedical Engineering deals with signals from human body which has to be processed to get useful output. Current technology processes everything in digital. This course provides basic knowledge on preprocessing algorithms like filtering and processors which are used to implement the same

c) Prerequisite

Signals and Systems

d) Related Courses

Microprocessor and Microcontrollers, Image Processing

e) Course Outcomes

Upon successful completion of the course students will be able to

CO. Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Generating different types of signal	S2
2	Analyze the signal	S2
3	Design filter for the EEG signal	S3
4	Comparing different filter configurations in GUI	S2
5	Implement DSP coding in CCSTUDIO using C6713/MSP430	S2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			2				1			1	2	1
CO2	2	1			2				1			1	2	1
CO3	3	2			2				1			1	3	1

CO4	2			2				1			1		1
CO5	3	2		3				1			1	2	1

LIST OF EXPERIMENTS

1. Waveform Generation
2. Basic operation on DT signal
3. Demonstration of sampling and aliasing
4. Spectrum estimation of EEG using FFT
5. Delta Frequency extraction from EEG
6. Classification of Brain Waves
7. Writing MATLAB filter coefficient to C header file
8. Comparing different filter configurations using DSP LIB GUI
9. Demonstration of Aliasing using MATLAB sound command
10. Generation of Sine Wave using CCSTUDIO for C6713/MSP430 DSP processor
11. Verifying Linear Convolution using CCSTUDIO for C6713/MSP430 DSP processor
12. Impulse Response using CCSTUDIO for C6713/MSP430 DSP processor
13. DFT-16 Point using CCSTUDIO for C6713/MSP430 DSP processor

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10211BM306	Biomedical Instrumentation Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

Biomedical engineering deals with human physiology signals like ECG,EEG etc. This course gives a hands on for recording and measuring such waveforms for the diagnosis a

c) Prerequisite

Analog and Digital Circuits.

d) Related Courses

Bio Medical Instrumentation.

e) Course Outcomes

Upon successful completion of the course students will be able to

CO. Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Record the bio signals from various regions of the body	S2
2	Measure the bio signals.	S2
3	Design preamplifiers for measuring the bio signals in hardware and software.	S3
4	Measure non electrical parameters of the body.	S2
5	Demonstrate biofeedback system.	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3							1	2	3
CO2	3	2	3	2	3							1	2	3
CO3	3	2	3	3	3							1	2	3

CO4	3	2	3	2	3							1	2	3
CO5	3	2	3	2	3							1	2	3

LIST OF EXPERIMENTS

1. Measurement of blood pressure
2. Design and testing of preamplifiers for various biomedical instruments
3. Development of ECG amplifiers and filters
4. Recording of ECG signal.
5. Measurement of respiratory parameters using spirometer
6. Recording of EMG-Signal
7. Recording of EEG-Signal.
8. Recording EEG with stimulus.
9. Heart sound measurement using PCG
10. Galvanic skin resistance (GSR) measurement

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10211BM307	Diagnostic and Therapeutic Equipments Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

- To demonstrate recording and analysis of different Bio potentials
- To examine different therapeutic modalities.

c) Prerequisite

Analog and Digital Circuits

d) Related Courses

Bio Medical Instrumentation, Diagnostic & Therapeutic Equipment's

e) Course Outcomes

Upon successful completion of the course students will be able to

CO. Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Measurement of various physiological signals using biotelemetry.	S2
2	Demonstrate Audiogram	S2
3	Acquire ECG, EEG and EMG signals using simulator	S2
4	Measurement of various biological parameters using Patient monitoring system	S2
5	Use of Diathermy for ESU application.	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		2	3							1	2	3
CO2	3	2		2	3							1	2	3
CO3	3	2		3	3							1	2	3

CO4	3	2		2	3							1	2	3
CO5	3	2		2	3							1	2	3

LIST OF EXPERIMENTS

1. Measurement of various physiological signals using biotelemetry
2. Study of medical stimulator
3. Analyse the working of ESU – cutting and coagulation modes
4. Recording of Audiogram
5. Analysis of ECG, EEG and EMG signals using simulator
6. Pure tone conduction measurement using audiometer
7. Real-time wireless health monitoring using mobile devices
8. Real time monitoring and comprehensive determination of emotional characteristics from physiological parameters.
9. ECG heart rate alarm using patient monitoring
10. Working methods of shortwave diathermy.

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10212BM101	Hospital Management	3	0	0	3

a) **Course Category**
Programme Elective

b) **Preamble**
This course covers the conceptual and technical knowledge required to administer a hospital

c) **Prerequisite**
None

d) **Related Courses**
None

e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the factors which differentiates the hospital administration from Industrial administration Comprehend and appreciate the significance and role of this course in the present contemporary world	K2
CO2	Explain how Human resource management is done in hospital environment Explain the principles, practices and areas of application in Hospital Management	K2
CO3	Apply various business strategies and behavioral models	K3
CO4	Discuss the role of different information systems and services in hospital environment	K2
CO5	Utilize the various quality and safety measure that has to be followed in hospital	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	1					3		
CO2								2	3		3	3		
CO3						3			2	3	3			
CO4						2		1			1			
CO5						3		2	1					

f) Course content

UNIT-I OVERVIEW OF HOSPITAL ADMINISTRATION

7

Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning – Equipment Planning – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management

UNIT-II HUMAN RESOURCE MANAGEMENT ON HOSPITAL

9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer.

UNIT-III MARKETING RESEARCH & CONSUMER BEHAVIOUR

10

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - Types of buying decision behaviour - The buyer decision process - Model of business buyer behaviour - Major types of buying situations - global marketing in the medical sector.

UNIT-IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

10

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

UNIT-V QUALITY AND SAFETY ASPECTS IN HOSPITAL

9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – ISO 13485, Environment Management Systems. NABA, JCI, NABL, NABH. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care - Medical Audit – Hazard and Safety in a hospital Setup.

Total: 45 Hrs.

g) Learning Resources

Text Books

- [1] D.K. Sharma, R.C.Goyal. *Hospital Administration and Human Resource Management*. 4th ed, PHI learning, 2006.
- [2] G.D.Kunders. *Hospitals: Facilities Planning and Management*. 5th ed, New Delhi, Tata McGraw-Hill Publishing, 2007.

References Books:

- [1] Cesar A. Caceres, Albert N. Zara. *The Practice of Clinical Engineering*. New York, Academic Press, 1977.
- [2] Peter Berman. *Health Sector Reform in Developing Countries*. Harvard University Press, 1966.
- [3] Stephen M. Shortell, Arnold D. Kaluzny. *Health Care Management: Organisational Design and Behaviour*. Thomson Delmar Learning, 2006.

Course Code	Course Title	L	T	P	C
10212BM102	Telehealth Technology	3	0	0	3

a. **Course Category**
Programme Elective

b. **Preamble**
This course helps the students to learn about the E Healthcare with their standards. Also this course gives the detail information about the security, transmission, and storage

c. **Prerequisite**
None

d. **Related Courses**
None

e. **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the basic principles of healthcare in telemedicine.	K2
CO2	Compare the different types of communication and networks	K2
CO3	Solve the ethical & legal issues involved in telemedicine.	K3
CO4	Apply the different types of data storage and communication standards used in telehealth system.	K3
CO5	Discuss the various applications of telemedicine.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			2								
CO2	3		1			3								
CO3	1		1			1								
CO4	3		1			3								
CO5	3		1			3								

f. Course content

UNIT I History and Fundamentals of Telemedicine

9

Origin and Development of telemedicine, definition of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, benefits & limitations of telemedicine, Future of Telemedicine.

UNIT II Communication & Network

9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Amplitude Modulation (Qualitative Analysis), Communication infrastructure for telemedicine – LAN and WAN technology.

UNIT III Ethical and legal aspects of Telemedicine

9

Ethical and legal aspects of Telemedicine (Case study) - Confidentiality, Social and legal issues (Case Study), Safety and regulatory issues (Case Study), the patient-doctor relationship, access to medical records, consent treatment - data protection & security.

UNIT IV Picture Archiving and Communication System

9

Types of image formats, DICOM standard, PACS system: Block diagram, Storing & retrieving images, Algorithm for retrieving images, Compressions and its significance, Lossless data Storage and in-house communication.

UNIT V Applications of Telemedicine

9

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, e Health care.

Total: 45 Hrs.

g. Learning Resources

Textbooks

- [1] Olga Ferrer-Roca, M.Sosa Ludicissa. *Handbook of Telemedicine*. IOS press 2002.
- [2] Norris A.C. *Essentials of Telemedicine and Telecare*. John Wiley & Sons, 2002.
- [3] Wootton R, Craig J, Patterson. *Introduction to Telemedicine*. 2nd ed, Royal Society of Medicine Press Ltd., 2006.

References Books:

- [1] Maheu M.M, Whitten P, Allen A. *E-Health, Telehealth, and Telemedicine: A guide to start-up and success*. John Wiley & Sons, 2001.
- [2] Keith J, Dreyer, David S, Hirschorn, James Thrall H, Amit Mehta. *PACS: A Guide to the Digital Revolution*. 2nd ed, Springer, 2006.
- [3] Huang H K. *PACS and imaging informatics – Basic Principles & application*. 2nd ed, Wiley-Blackwell, 2010.
- [4] Latifi R. *Current Principles and Practices of Telemedicine and e-Health*. Washington DC: IOHS , 2008.
- [5] Bashshur R L, Shannon G W. *History of Telemedicine*. New Rochelle NY, Mary Ann Liebert Publishers, 2009.

Course Code	Course Title	L	T	P	C
10212BM103	Medical Ethics	3	0	0	3

a. **Course Category**
Programme Elective

b. **Preamble**

- To achieve familiarity with some basic ethical framework & understand how these ethical frameworks can help us to think through contemporary questions in medical ethics.
- To know about the legal and ethical principles and application of these in medical field.
- Gain knowledge about the medical standards that to be followed in hospitals

c. **Prerequisite**
None

d. **Related Courses**
None

e. **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the ethical codes applicable to hospitals.	K2
CO2	Apply the moral values and ethics in their work environment	K3
CO3	Discuss the confidentiality issues in medical practice.	K2
CO4	Choose and apply relevant standards.	K3
CO5	Explain the ethics in maintenance and disposal of equipments and materials in hospital use.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1					2		3						
CO2	1					2		3						
CO3	1					1		3						
CO4	1					2		2						
CO5	1					3		3						

f. Course content

UNIT I INTRODUCTION TO MEDICAL ETHICS 9

Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics- Fundamental Responsibilities, The Doctor and the Patient, The Doctor and the Profession, Professional Independence, The Doctor and Society.

UNIT II ETHICAL THEORIES & MORAL PRINCIPLES 9

Theories-Deontology & Utilitarianism, Casuist theory, Virtue theory, The Right Theory. Principles - Non-Maleficence, Beneficence, Autonomy, Veracity, Justice.

UNIT III ETHICAL ISSUES 9

Autonomy & Confidentiality issues in medical practice, Ethical Issues in biomedical research, Bioethical issues in Human Genetics & Reproductive Medicine.

UNIT IV HOSPITAL ACCREDITATION AND SAFETY STANDARDS 9

Hospital accreditation standards, Accreditation- JCI Accreditation & its Policies. Patient centered standards, Healthcare Organization management standards.

Life Safety Standards- Protecting Occupants, Protecting the Hospital From Fire, Smoke, and Heat, Protecting Individuals From Fire and Smoke, Providing and Maintaining Fire Alarm Systems, Systems for Extinguishing Fires Environment of Care Standards-Minimizing EC Risks, Smoking Prohibitions.

UNIT V WASTE AND SAFETY MANAGEMENT 9

Managing Hazardous Material and Waste, Maintaining Fire Safety Equipment, Features, Testing, Maintaining, and Inspecting Medical Equipment.

Total : 45 Hrs.

g. Learning Resources

Text Books

[1] Domiel A Vallero. *Biomedical Ethics for Engineers*. 1st ed. Elsevier, 2007.

References Books:

[1] Johnna Fisher. *Biomedical Ethics: A Canadian Focus*. Oxford University Press Canada, 2009

[2] Robert M Veatch. *Basics of Bio Ethics*. 2nd ed. Prentice- Hall Inc, 2003.

Course Code	Course Title	L	T	P	C
10212BM104	Body Area Networks	3	0	0	3

a. Course Category

Program Elective

b. Preamble

This course will help the students to understand about body area networks along with the various hardwares used and their applications.

c. Prerequisite

Analog and Digital Communication

d. Related Courses

None

e. Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain about working of Body Area Network	K2
CO2	Explain the hardware used for BAN with LAN/WAN	K2
CO3	Explain the wireless communication infrastructure used for BAN.	K2
CO4	Discuss the technical challenges involved in BAN	K2
CO5	Brief on the applications of BAN.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1											1	
CO2	1													
CO3	1													
CO4		1												
CO5	1	2											2	

f. Course content

UNIT I INTRODUCTION

9

Definition, BAN and Healthcare, Technical Challenges- Sensor design, biocompatibility, Energy Supply, optimal node placement, number of nodes, System security and reliability, BSN Architecture –Introduction

UNIT II HARDWARE FOR BAN

9

Processor-Low Power MCUs, Mobile Computing MCUs ,Integrated processor with radio transceiver, Memory, Antenna-PCB antenna, Wire antenna, Ceramic antenna, External antenna, Sensor Interface, Power sources- Batteries and fuel cells for sensor nodes.

UNIT III WIRELESS COMMUNICATION AND NETWORK

9

RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand –Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1, IEEE P802.15.3, IEEE 802.15.4, Zigbee

UNIT IV COEXISTENCE ISSUES WITH BAN

9

Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self protection-Bacterial attacks, Virus infection ,Secured protocols, Self protection.

UNIT V APPLICATIONS OF BAN

9

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhythmia monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

Total: 45 Hrs.

g. Learning Resources

Text Books

- [1] Annalisa Bonfiglio, Danilo De Rossi. *Wearable Monitoring Systems*. Springer, 2011.
- [2] Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkatasubramanian. *Body Area Networks Safety, Security, and Sustainability*. Cambridge University Press, 2013.
- [3] Guang-Zhong Yang. *Body Sensor Networks*. Springer, 2006.

Course Code	Course Title	L	T	P	C
10212BM105	Introduction To Nanotechnology	3	0	0	3

a) **Course Category**

Program Elective

b) **Preamble**

The course introduces the underlying principles and applications of the emerging field of nanotechnology. It introduces tools and principles relevant at the nanoscale dimensions. Also it discusses current and future nanotechnology applications in biomedical engineering and electronics.

c) **Prerequisite**

Basic physics and material science.

d) **Related Courses**

None

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain about the underlying principles in nanotechnology	K2
CO2	Explain nanomaterials synthesis processes and fabrication techniques	K2
CO3	Explain different nanomaterial characterization techniques	K2
CO4	Describe the application of nanotechnology in biomedical engineering	K2
CO5	Describe the usage of nanotechnology in electronics	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1			1							
CO2	2	2	1	3				3						
CO3	2	2	2	2										
CO4	2	2	2	3			2	2						
CO5	2	2	2	3			2	2						

f) Course content

UNIT I INTRODUCTION

9

History, background scope and interdisciplinary nature of nanotechnology, scientific revolutions, nano sized effects surface to volume ratio, crystal structure, atomic structure, molecules and phases, energy bands - insulators, semiconductors and conductors, Nanoscale - molecular and atomic size, quantum effects.

UNIT II NANOMATERIALS SYNTHESIS

9

Synthesis and nanofabrication, Bottom-Up and Top-Down approach with examples. Chemical Methods - Precipitation Method, Sol-Gel Method, Sonochemical Synthesis, Hydrothermal, Thermal Decomposition Process. Physical Methods - Ball milling, Physical Vapor deposition (PVD), Chemical Vapor deposition (CVD), Sputter Deposition, Lithography techniques. Biological methods - Synthesis using micro-organisms and bacteria, Synthesis using plant extract, use of proteins and DNA templates.

UNIT III MATERIAL CHARACTERIZATION TECHNIQUES

9

Compositional and Structural Characterization techniques: X-ray, Principles and applications of X-ray diffraction; electron diffraction, Surface characterization Techniques - High resolution microscopy; Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM). Spectroscopic techniques: Fourier Transform infrared (FTIR) spectroscopy, Raman spectroscopy techniques.

UNIT IV NANO IN BIOMEDICAL APPLICATIONS

9

Introduction, Biological building blocks - size of building blocks and nanostructures, Nanomaterials in drug delivery and therapeutics, Nanomedicine, Targeted nanoparticles for imaging and therapeutics

UNIT V NANO IN ELECTRONICS APPLICATIONS

9

Introduction, Electronic structure of Nanocrystals, Tuning the Band gap of Nanoscale semiconductors, Excitons, Quantum dot, Single electron devices, Nanostructured ferromagnetism, Effect of bulk nano-structuring of magnetic properties, Dynamics of nanomagnets, Nanocarbon ferro-magnets, Giant and colossal magnetoresistance, Introduction of spintronics, Spintronics devices and applications.

Total: 45 Hrs.

g) Learning Resources

Text Books

- [1] T. Pradeep. *NANO The Essential , understanding Nanoscience and Nanotechnology*. Tata McGraw-Hill Publishing Company Limited, 2007.
- [2] Charles P. poole jr. and frank J.Owens. *Introduction to Nanotechnology*. John Wiley & Sons, 2003.
- [3] C.N.R. Rao, A. Muller and A.K. Cheetham. *The Chemistry of nanomaterials: Synthesis, Properties and Applications Vol-I*. John Wiley & Sons, 2004.
- [4] George W. Hanson. *Fundamentals of Nanoelectronics*. Pearson, 2007.

Course Code	Course Title	L	T	P	C
10212BM106	Rehabilitation Engineering	3	0	0	3

a) **Course Category**
Programme Elective

b) **Preamble**
Rehabilitation engineering will provide knowledge to design rehabilitation aid and apply them with confidence to help the challenged people.

c) **Prerequisite**
Engineering Mechanics

d) **Related Courses**
DTE

e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the need of Rehabilitation Engineering	K2
CO2	Identify different types of Therapeutic Exercise Techniques	K2
CO3	Compare various orthotic & prosthetic devices in healthcare	K3
CO4	Summarized the various assistive technology used for vision	K2
CO5	Design hearing aids for the given parameters	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			1		2	1			1		3
CO2	3		3	1		2	2					1		3
CO3	1		3		2	3	3	2				1		2
CO4	3		1		2	3	3	2				1		2
CO5	3		3		2	3	3	2				1		1

f) Course content

UNIT I INTRODUCTION TO REHABILITATION ENGINEERING 9

What is Rehabilitation, Medical Rehabilitation, Preventive Rehabilitation, Impairment disability and handicap, Sociovocational Rehabilitation, Rehabilitation team, Delivery of Rehabilitation care, Community Based Rehabilitation (CBR).

UNIT II THERAPEUTIC EXERCISE TECHNIQUE 9

Co-ordination exercises, Frenkels exercises, Gait analyses-Pathological Gaits, Gait Training, Relaxation exercises-Methods for training Relaxation, Strengthening exercises-Strength training, Types of Contraction, Mobilisation exercises, Endurance exercises.

UNIT III - ORTHOTIC & PROSTHETIC DEVICES 9

Anatomy of upper & lower extremities, Classification of amputation types, Prosthesis, Components of upper limb prosthesis, Fabrication of prosthesis, Components of lower limb prosthesis ,Orthoses, types – Lower extremity- and upper extremity orthoses .

UNIT IV – VISUAL AIDS 9

Anatomy of eye, Categories of visual impairment, Cortical & retinal implants, Ultrasonic and laser canes, Intra ocular lens, Braille Reader, Tactile devices for visually challenged, Text voice converter, screen readers.

UNIT V AUDITORY AND SPEECH ASSIST DEVICES 9

Anatomy of ear, Types of deafness, hearing aids, application of DSP in hearing aids, Cochlear implants, Voice synthesizer, speech trainer.

Total: 45 Hrs.

g) Learning Resources

Text books:

- [1] S Sunder. *Textbook of Rehabilitation*. 2nd ed, Jaypee Brothers Medical Publishers Pvt. Ltd, 2007.
- [2] Joseph D.Bronzino. *The Biomedical Engineering Handbook*. 3rd ed, Taylor & Francis, 2006.
- [3] Rory A Cooper, Hisaichi Ohnabe, Douglas A Hodson. *An Introduction to Rehabilitation Engineering*. 1st ed, CRC Press, 2006.

References Books:

- [1] Horia- Nocholai Teodorecu, L.C.Jain. *Intelligent systems and technologies in rehabilitation Engineering*. CRC Press, 2000.
- [2] Keswick. J. *What is Rehabilitation Engineering, Annual Reviews of Rehabilitation*. Springer, 1982.
- [3] Warren E. Finn, Peter G. LoPresti. *Handbook of Neuroprosthetic Methods*. CRC Press, 2002.
- [4] Levine.S.N.Editor. *Advances in Bio Medical Engineering and Medical Physics*. Inter University Publication, 1968.
- [5] Albert M.Cook and Webster J.G. *Therapeutic Medical devices*. Prentice Hall Inc, 1982.
- [6] Reswick.J. *What is Rehabilitation Engineering-Annual review of Rehabilitation-volume2*. Springer, 1982.

Course Code	Course Title	L	T	P	C
10212BM107	Robotics in Medicine	3	0	0	3

a) **Course Category:**
Program Elective

b) **Preamble**
This course helps the students to learn about the medical robots with their applications. Also this course gives the detail information about the design methodology in health care application.

c) **Prerequisite**
None.

d) **Related Courses**
Engineering mechanics

e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the various types of robot in health care application	K2
CO2	Identify and compare the various types of tracking mechanisms for medical robot	K2
CO3	Explain the coordinate system of medical robot	K2
CO4	Choose the appropriate design methodology of medical robots based on their application.	K3
CO5	Illustrate the working principle of Assistive robots.	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	¹													

CO2	2	1	2	1		1						2		
CO3	2	1	2	1								2		
CO4	3	2	2	2								2		
CO5	2		1									2		

f) Course content

UNIT I INTRODUCTION

7

Types of medical robots - Navigation - Motion Replication - Imaging - Rehabilitation and Prosthetics - State of art of robotics in the field of healthcare.

UNIT II LOCALIZATION AND TRACKING

8

Position sensors requirements - Tracking - Mechanical linkages - Optical - Sound-based - Electromagnetic - Impedance-based - In-bore MRI tracking - Video matching - Fiber optic tracking systems - Hybrid systems.

UNIT III SURGICAL ROBOTICS

10

Minimally invasive surgery and robotic integration – surgical robotic sub systems - synergistic control. Control Modes - Radiosurgery - Orthopedic Surgery - Urologic Surgery and Robotic Imaging - Cardiac Surgery – Neurosurgery – case studies.

UNIT IV REHABILITATION & DESIGN OF MEDICAL ROBOTS

14

Rehabilitation for Limbs - Brain-Machine Interfaces - Steerable Needles – case studies, Characterization of gestures to the design of robots- Design methodologies- Technological choices- Security.

UNIT V ROBOTS IN MEDICAL CARE

6

Assistive robots –types of assistive robots – case studies.

Total: 45 Hrs

g) Learning Resources

Text books:

[1] Mark W. Spong, Seth Hutchinson, and M. Vidyasagar. *Robot Modeling and Control*. Wiley Publishers, 2006.

[2] Paula Gomes. *Medical robotics Minimally invasive surgery*. Woodhead, 2012.

References:

- [1] Achim Schweikard, Floris Ernst. *Medical Robotics*. Springer, 2015.
- [2] Jocelyne Troccaz. *Medical Robotics*. Wiley-ISTE, 2012.
- [3] Vanja Bonzovic. *Medical Robotics*. I-tech Education publishing, 2008.

Course Code	Course Title	L	T	P	C
10212BM108	Biomedical Informatics	3	0	0	3

a) Course Category:

Program Elective

b) Preamble

This course gives an ability to learn ICT applications in medicine with an introduction to health informatics. Understand the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in Hospital Information Systems.

c) Prerequisite

None.

d) Related Courses

DICOM, Telehealth Technology

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the concept of various types of informatics and its application	K2
CO2	Relate the different levels of medical standards	K2
CO3	Illustrate the basic structure and formats of medical storage	K2
CO4	Explain the models of informatics and databases	K2
CO5	Explain the recent trends and activities of informatics	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													

CO2	2	1	2	1		1						2		
CO3	2	1	2	1								2		
CO4	3	2	2	2								2		
CO5	2		1									2		

f) Course content

UNIT I MEDICAL INFORMATICS

9

Introduction – Medical Informatics – Bioinformatics – Health Informatics - Structure of Medical Informatics –Functional capabilities of Hospital Information System - On-line services and off – line services - Dialogue with the computer, Application.

UNIT II MEDICAL STANDARDS

9

History and Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA –Electronics Patient Records – Healthcare Standard Organizations – JCAHO (Joint Commission on Accreditation of Healthcare Organization) - JCIA (Joint Commission International Accreditation) - Evidence Based Medicine - Bioethics.

UNIT III MEDICAL DATA STORAGE AND AUTOMATION

9

Representation of Data, Data modeling Techniques, Relational Hierarchical and network Approach, Normalization techniques for Data handling - Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface – Medical Data formats – Signal, Image and Video Formats – Medical Databases - Automation in clinical laboratories - Intelligent Laboratory Information System – PACS and its significances.

UNIT IV HEALTH INFORMATICS

9

Bioinformatics Databases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics, Education and Training

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS

9

Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment – Surgical simulation - Radiation therapy and planning – Telemedicine – virtual Hospitals - Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine.

Total: 45 Hrs

g) Learning Resources

Text Books:

- [1] R.D.Lele. *Computers in medicine progress in medical informatics*. Tata McGraw Hill Publishing Ltd, 2005.
- [2] Mohan Bansal. *Medical informatics*. Tata McGraw Hill Publishing Ltd, 2003.

References Books:

- [1] Orpita Bosu and Simminder Kaur Thukral. *Bioinformatics Databases, Tools and Algorithms*. Oxford University press, 2007.
- [2] Yi Ping Phoebe Chen. *Bioinformatics Technologies*. Springer, 2007.

Course Code	Course Title	L	T	P	C
10212BM119	MEDICAL OPTICS	3	0	0	3

a) **Course Category**

Program Elective

b) **Preamble**

This course deals with the optical devices and various applications of Lasers in diagnosis and therapy.

c) **Prerequisite**

Basic knowledge of Analog & Digital Electronics & Engineering Physics.

d) **Related Courses**

Medical Physics.

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the basic concepts of optical properties and their interaction with the tissues.	K2
CO2	Discuss the different measurement techniques and compare how various photonic principles used in instrumentation	K2
CO3	Determine the various kinds of Lasers used in medicine & Apply the Lasers techniques in Surgery	K3
CO4	Explain the various applications of laser in diagnosis and therapy.	K2
CO5	Illustrate the use of Lasers that can be used for specific medical applications.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1		2	2	1				2	1	2
CO2	3	2	1	1		2	2	1				2	1	2
CO3	3	2	1	1		2	2	1				2	1	2
CO4	3	2	1	1		2	2	1				2	1	2
CO5	3	2	1	1		2	2	1				2	1	2

f) Course content

UNIT-I OPTICAL PROPERTIES OF THE TISSUES 9

Refraction, Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Optothermal interaction- Electromechanical – Photoablativ processes.

UNIT II INSTRUMENTATION IN PHOTONICS 9

Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, LASERs, Optical filters, polarisers, optical detectors – Time resolved and phase resolved detectors.

UNIT III SURGICAL APPLICATIONS OF LASER 9

LASER-Characteristics, Types of Laser, construction and working principle, Laser applications- Lasers in ophthalmology- Dermatology –Dentistry-Urology-Otolaryngology - Tissue welding.

UNIT IV - NON THERMAL DIAGNOSTIC APPLICATIONS 9

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and speckle application of lasers in biology and medicine.

UNIT V - THERAPEUTIC APPLICATIONS 9

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism -Oncological and non-oncological applications of PDT – Bio-stimulation effect – applications-Laser Safety Procedures-Regulatory standards for Radiation Safety.

(g) Learning Resources

Text Books

[1] MarkolfH.Neimz. *Laser tissue interactions-Fundamentals and applications*, 3rd ed, Springer, 2014.

[2] Paras N. Prasad. *Introduction to Biophotonics*. John Wiley and Sons, Inc. Publications, 2004

Reference Books

[1] Abraham Katzir. *Lasers and Optical Fibers in Medicine*, Academic Press Edition,1998.

[2] Tuan VoDirh. *Biomedical Photonics – Handbook*, CRC Press, 2003.

[3] G.David Baxter. *Therapeutic Lasers – Theory and practice*, Churchill Livingstone Publications Edition, 2001.

[4] Helena Jelinkova. *Lasers for medical applications: Diagnostics, Therapy and Surgery*. 1st ed, Woodhead Publishing, 2013.

Course Code	Course Title	L	T	P	C
10212BM120	MEDICAL DEVICE REGULATORY AFFAIRS	3	0	0	3

a) Course Category

Program Elective

b) Preamble

To make the student to acquire knowledge on various regulatory practices in handling biomedical devices

c) Prerequisite

Diagnostic and Therapeutic Equipments

d) Related Courses

Biomedical Instrumentation

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Classify a medical device according to classification guide	K3
CO2	Analyse the risk in in using and managing the medical equipment	K3
CO3	Explain the regulatory standards and procedures followed to maintain the quality of medical devices	K2
CO4	Explain the various standards involved in Safety testing	K2
CO5	Explain how to test and inspect diagnostic and therapeutic devices.	K2

f) Course content

UNIT I MEDICAL DEVICE CLASSIFICATION 9

Overview of Medical Devices, IVD device classifications – class I, II, III, Classification guide, IDE submission and labeling, IEC standards and its significance, **India-Regulatory overview and classification.**

UNIT II RISK ANALYSIS AND MANAGEMENT

9

ISO 14971, ISO 14971:2007, Risk analysis techniques, Risk management framework and process , case studies.

UNIT III QUALITY MANAGEMENT SYSTEMS 9

ISO 13485, ISO 9000, Implementing ISO 13485:2003, ISO 13485:2012 – 4 tier setup and implementation, 13485:2015.

UNIT IV SAFETY TESTING FOR NEW MEDICAL DEVICES 9

Directive 2011/65/EU, ISO 10993 – 5, ISO 10993 –11, ISO 10993 –4, ISO 10993 –9, ISO 10993 –7, ISO 10993 –1, ISO 13857:2008, ISO 17025, **IEC 60601-1 and 2.**

UNIT V INSPECTION AND TESTING OF MEDICAL EQUIPMENTS 9

Diagnostic: **Patient Monitoring(ECG, BP device, EEG, EMG)**, Evoked Response equipment

Therapeutic: Defibrillator, Anesthesia, Dialyser, Neonate Incubator

Assist - Respirators

Total 45 Hrs.

h) Learning Resources

Text Books

[1] Jack Wong, Raymond Tong. *Handbook of Medical Device Regulatory Affairs in Asia*. 2nd ed, Jenny Stanford Publishing, 2018.

[2] Beth Ann Fiedler. *Managing Medical Devices Within a Regulatory Framework*. Elsevier, 2017.

[3]Liao, Susan, Ramakrishna, Seeram, Teo, WeeEong, Tian, Lingling, Wang, Charlene. *Medical devices regulations, standards and practices*. Woodhead Publishing, 2015.

Reference Books

- [1] Almir Badnjević, Mario Cifrek, Ratko Magjarević. *Inspection of Medical Devices For Regulatory Purposes*. Springer, 2017
- [2] Jack Wong, Raymond K. Y. Tong. *Medical Regulatory Affairs An International Handbook for Medical Devices and Healthcare Products*. 3rd ed, Taylor Francis Group
- [3] Stephen F. Amato. *Regulatory Affairs for Biomaterials and Medical Devices*. Woodhead Publishing, 2015

Course Code	Course Title	L	T	P	C
10212BM121	Tissue Engineering	3	0	0	3

a) Course Category

Program core

b) Preamble

Tissue Engineering combines knowledge and technologies from different fields such as biology, chemistry, medicine, engineering, material science and nanotechnology. It helps biomedical engineers to develop products for repair or replacement of damaged tissues and organs.

c) Prerequisite

Biomaterials

d) Related Courses

Pathology and microbiology

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Compare the biology of normal cells, stem cells and tissues	K2
CO2	Explain properties of different biomaterials utilized for tissue engineering/replacements	K2
CO3	Explain the basic components required for in vitro tissue engineering	K2
CO4	Compare various methodologies available for designing scaffolds and bioreactors for tissue engineering	K2
CO5	Explain how tissue engineering concepts are applied in developing cartilage, bone and organs	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1								1		
CO2	3	2	3	3			2	2	2	2	2	2		3
CO3	3	2	3	3	3		2	3	2	2	2	3		3
CO4	3	2	3	3	3		2	3	2	2	3	3		3
CO5	3	2	3	3	3		2	3	2	2	3	3		3

Unit 1: Fundamentals

9 Hrs

Introduction to Tissue engineering, Cells – Basic Molecular Biology and Molecular Organization, Stem Cells – Growth and Differentiation, Tissue Morphogenesis, Tissue Homeostasis and Extracellular matrix (ECM) as a biological scaffold. Mechanobiology - Mechanical forces, Mechano-sensing and Mechanotransduction.

Unit 2: Biomaterials for Engineering

9 Hrs

Natural Polymers - Polysaccharides, Proteins, Polyhydroxyalkanoates, Properties, Biodegradable Polymers - Mechanism of Polymer Degradation. Bioceramics and their degradation. Biocompatibility of Polymers and Bioceramics

Unit 3: Essentials for In vitro Engineering

9 Hrs

Engineering Functional Tissues: Key Concepts and Importance. Cell Culture – Harvest, Selection, Expansion, and Differentiation, Cell Nutrition - Cell Culture Media, Directing Cellular Behaviour, Mass Transport, Nutrient Gradients and Strategies to Improve Nutrient Supply –Formation of Vasculature, Bioreactor, and Scaffolds with Nutrient Channels

Unit 4: Scaffolds and Bioreactors

9 Hrs

Scaffolds – Design, Morphology/Architecture, Fabrication Techniques and Biomaterials, Textile Technologies and Solid-Free Form Fabrication - Systems based on Laser and UV light Sources and Extrusion/Direct Writing, 3D Printing and 3D Bio-printing. Bioreactors – Key Functions, Design and Development, 3D Model Systems and Clinical Applications

Unit 5: In Vivo Applications

9 Hrs

Tissue Engineering of Cartilage. Tissue Engineering of Bone. Tissue Engineering of Organs – Urogenital Tissues, Liver Tissues, Lung Tissues, Gut and Pancreas Tissues. Ethical issues - Morality, ethics and values.

Text Books

[1] Robert Lanza, Robert Langer, Joseph Vacanti. *Principles of Tissue Engineering*. 5th ed, Elsevier, 2020.

[2] Clemens Van Blitterswijk. *Tissue Engineering*. Elsevier, 2008.

Reference Books

[1] Robert A. Brown. *Extreme Tissue Engineering - Concepts and Strategies for Tissue Fabrication*. Wiley-Blackwell, 2012.

[2] Bernhard O.Palsson, Sangeeta N.Bhatia. *Tissue Engineering*. Pearson Publishers 2009.

[3] W Mark Saltzman. *Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues*. Oxford University Press, 2004.

Course Code	Course Title	L	T	P	C
10212BM201	Digital Imaging and Communication In Medicine	1	0	4	3

a) **Course Category**

Program Elective/ Integrated

b) **Preamble**

This course gives an introduction to DICOM standards and will discuss the application of various imaging processing techniques to DICOM images.

c) **Prerequisite**

None

d) **Related Courses**

Image Processing

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Skill Level (Dave's Taxonomy)
CO1	Explain the terminologies of DICOM and its standards.	S2
CO2	Demonstrate how medical images can be manipulated in DICOM	S2
CO3	Experiment with recent applications of DICOM	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		1		2	3		2	2	2		1		1
CO2	3	2	2		1		3	2		1		1		1
CO3	3	1	2	3	2	2		2				1		1

f) Course content

UNIT I INTRODUCTION TO DICOM **5**
What is DICOM? How does DICOM works, DICOM introduction and history, DICOM File Format, PACS, DICOM Security, DICOM Standards

UNIT II PREPROCESSING TECHNIQUE IN MEDICAL IMAGES **5**
Resize the Image, Conversion of Images, Noise addition, Noise Removal, Image Enhancement Technique.

UNIT III APPLICATIONS OF DICOM **5**
Image Registration, Image Fusion, Performance Evaluation, Image Compression

LIST OF EXPERIMENTS:

1. Read and display single and multiple DICOM images
2. Conversion of DICOM image
3. Alter, Add, or Erase metadata in DICOM image
4. Resizing of DICOM image
5. Image enhancement
6. Histogram equalization
7. Reconstruction of the DICOM image
8. Medical Image registration
9. Medical Image fusion
10. Performance evaluation of image fusion
11. Feature Extraction in Medical images
12. Steganography

15 Hrs.

60 Hrs.

Total:75 Hrs.

g) Learning Resources

Text Books

- [1] O.S Pianykh. *Digital Imaging and Communication in Medicine (DICOM)*. Springer, 2008.

Course Code	Course Title	L	T	P	C
10212BM202	Brain Computer Interface	1	0	4	3

- a) **Course Category**
Programme Elective/Integrated
- b) **Preamble**
This course helps to design the brain computer interface system using brain signals.
- c) **Prerequisite**
None
- d) **Related Courses**
Anatomy and Physiology of brain, Signals and systems and Digital signal processing
- e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Skill Level (Dave's Taxonomy)
CO1	Conduct the preprocessing of the EEG signals	S2
CO2	Demonstrate feature extraction and Classification techniques used in BCI	S3
CO3	Recording EEG signals using open BCI set up	S2
CO4	Perform the feature extraction and visualize it using EEGLAB	S2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1				1	1		1	2		1	1	1
CO2	3	2	1	1	1	1	1		1	2		1	2	1
CO3	3	2	2	2	2	1			2	2		1	3	1
CO4	2	1	1	1	2				2			1	3	

f) Course content

UNIT-I Brain computer interface	5
Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI, Brain signal acquisition systems- EEG, MEG, fNIRS, fMRI.	
UNIT-II EEG features and stimulus design used in BCI	5
EEG-Temporal characteristics, Spatial Characteristics, Oscillatory EEG activity, event-related potentials (ERP), slow cortical potentials (SCP), and neuronal potentials, Motor Imagery, Stimulus design-RSVP, checkerboard.	
UNIT-III Signal processing of BCI and Medical applications	5
Signal Processing-Spatial, temporal, spectral, spatio-temporal filters, Feature extraction-ICA, CSP, Classifier-LDA, SVM, Medical applications	

15 Hrs.

LIST OF EXPERIMENTS:

60 Hrs.

1. Study and collection of online EEG datasets
2. Designing of filter
3. Designing of Common Spatial Filter
4. CSP-feature extraction
5. Topoplot for validation
6. Linear Discriminant Analysis
7. LDA and SVM comparison
8. OpenBCI board interface
9. Acquisition of EEG using openBCI board
10. Import the following using EEGLAB-continuous data, event information, channel locations
11. Filter the line noise and bandpass filter the EEG data using EEGLAB
12. Remove the bad channels and bad data using EEGLAB
13. Plot the 2D ERP, 3D ERP, Channel spectra, time-frequency analysis

Total: 75 Hrs.

g) Learning Resources

References:

- [1] Nicolas-Alonso, Luis Fernando, and Jaime Gomez-Gil. 2012. *Brain Computer Interfaces, a Review*. *Sensors* 12, no. 2: 1211-1279. <https://doi.org/10.3390/s120201211>
- [2] <https://sccn.ucsd.edu/wiki/BCILAB> [Accessed on: April 2019].

[3] F. Lotte and C. Guan, *Spatially Regularized Common Spatial Patterns for EEG Classification*. 2010 20th International Conference on Pattern Recognition, 2010, pp. 3712-3715, doi: 10.1109/ICPR.2010.904.

[4] Fukunaga, Keinosuke. *Introduction to statistical pattern recognition*. Elsevier, 2013.

Course Code	Course Title	L	T	P	C
10212BM203	Biomedical Computational Modelling	1	0	4	3

- a) **Course Category**
Programme Elective/ Integrated
- b) **Preamble**
This course gives a hands-on using computational modeling tool in biomedical applications
- c) **Prerequisite**
None
- d) **Related Courses**
Anatomy and Physiology of brain, Engineering Mechanics, BMI
- e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Skill Level (Dave's Taxonomy)
CO1	Understand and design various flow models in COMSOL	S3
CO2	Understand and work with electric current modeling wizard in COMSOL	S3
CO3	Understand and work with RF and Heat Transfer modeling wizard in COMSOL	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		3									
CO2	3	2	1		3									
CO3	3	2	1		3									

f) Course content

UNIT-I FLOW MODELLING

9

Introduction to COMSOL Starting Screen; Making initial selections Theory for Laminar Flow interface- Laminar Flow interface in COMSOL- Fluid Structure interaction in network of blood vessels: Introduction- Model Definition- Notes about COMSOL Implementation- Modeling Instructions- Results and Discussion.

UNIT-II ELECTRIC CURRENT MODELLING

3

Introduction to the AC-DC branch in model wizard- The electromagnetic interfaces- Fundamentals of Electromagnetics- Theory of Electromagnetics- theory for the electrostatic interface- theory for the electric current interface- theory of magnetic and electric fields- Modeling a pacemaker electrode in COMSOL.

UNIT-III RF AND HEAT TRANSFER MODELLING

3

Heat Transfer Branch: Theory for heat transfer interfaces- Joule heating interface- introduction to RF Module in COMSOL- Specific Absorption Rate (SAR) in the human head- Model definition- Modeling Instructions- Results and discussion.

LIST OF EXPERIMENTS:

15 Hrs.

60 Hrs.

1. Fluid Structure interaction in network of blood vessels
2. Electro osmotic flow
3. Modeling a pacemaker electrode
4. Heat Tumor Ablation
5. Specific Absorption Rate (SAR) in the human head

Total: 75 Hrs.

g) Learning Resources

Text Books

[1] Multiphysics, C.O.M.S.O.L., and C.M.H.T. Module. *COMSOL multiphysics user's guide*. Version: COMSOL 4.3 (2012).

Reference Books

[1] Zhang, Guigen. *Introduction to integrative engineering: a computational approach to biomedical problems*. CRC Press, 2017.

[2] <https://www.comsol.com/learning-center> [Accessed on September 2019]

[3] <https://www.comsol.com/models?sort=publication> [Accessed on September 2019].

Course Code	Course Title	L	T	P	C
10212BM109	Introduction to Machine Learning	2	2	0	4

a) **Course Category**

Specialization

b) **Preamble**

This course will make the learner, apply machine learning to solve problems in biomedical engineering

c) **Prerequisite**

Artificial Neural Networks

d) **Related Courses**

Signals and Systems, Image processing

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the seven steps of Machine Learning.	K2
CO2	Apply various supervised learning algorithms on the given datasets.	K3
CO3	Analyze and group the unlabeled data items using various clustering techniques.	K4
CO4	Choose the appropriate method of feature selection, model selection and model evaluation.	K3
CO5	Differentiate semi-supervised and reinforcement learning and Apply the same to solve given problems.	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
--	-----	-----	-----	-----	-----	-----	-----	-----	-----	------	------	------	------	------

CO1	3	2		2	2				2					
CO2	3	2		2	2				2					
CO3	3	2		2	2				2					
CO4	3	2	2	2	2				2					
CO5	3	2	2	2	2				2					

f) Course content

UNIT-1: INTRODUCTION TO MACHINE LEARNING (7 + 0 = 7 Hrs)

Machine learning vs Traditional learning, Seven steps of machine learning, Applications of machine learning, Supervised learning, regression, classification, Unsupervised learning, Clustering, Reinforcement learning, Advantages and Disadvantages of Machine learning.

UNIT-II: SUPERVISED LEARNING ALGORITHMS (5 + 10 = 15 Hrs)

Introduction to Supervised learning, Naive Bayes Classifier Algorithm, Decision Tree Algorithm, K-Nearest Neighbour Algorithm, SVM Algorithm, Random Forest Algorithm.

UNIT-III: UNSUPERVISED LEARNING ALGORITHMS (5 + 10 = 15 Hrs)

Introduction to Unsupervised learning, K-means Clustering, Hierarchical Clustering, Association rule learning, Apriori Algorithm, Frequent Pattern (FP) Growth Algorithm, Gaussian Mixture Models (GMMs).

UNIT-IV: INTRODUCTION TO STATISTICAL LEARNING THEORY (7 + 6 = 13 Hrs)

Introduction to Statistical Learning, Feature Selection- Filters (Pearson Correlation, Chi-Squared, LDA (Linear Discriminant Analysis)- Embedded Methods- L1 regularization- L2 regularization- L1/L2 regularization, Model Selection- Resampling Methods (Random split, Time-based split, Bootstrap), Probabilistic measures (Akaike Information Criterion, Minimum Description Length), Model Evaluation- Classification Metrics- (Accuracy, Precision, Recall, F1 Score, AUC curve), Regression Metrics (Mean Squared Error, Root Mean Squared Error, Mean Absolute Error, Root Mean Squared Log Error) - Clustering Metrics (Dunn Index, Silhouette Coefficient, Elbow method).

UNIT-V: SEMI-SUPERVISED LEARNING, REINFORCEMENT LEARNING (6 + 4 = 10 Hrs)

Introduction to Semi-Supervised learning, Markov Decision Process (MDP), Bellman equations, Monte Carlo methods, Q-learning Algorithm, State-Action-Reward-State-Action (SARSA) Algorithm.

Total hrs- 60

TEXT BOOK

[1] Dr Ruchi Doshi. *Machine Learning- Master Supervised and Unsupervised Learning Algorithms with Real Examples*. BPB Publications, India, 2021.

REFERENCE BOOKS

- [1] Ryan T. White et al. *Practical Discrete Mathematics*. Packt Publishing, 2021.
[2] Stuart J. Russell and Peter Norvig. *Artificial Intelligence- A Modern Approach*. Fourth Edition, Pearson Education Limited, 2022.

Course Code	Course Title	L	T	P	C
10212BM204	Introduction to Deep Learning	3	0	2	4

a) **Course Category**

Major Specialization

b) **Preamble**

To understand different types of Deep Architectures, including Convolutional Networks and Recurrent Networks

c) **Prerequisite**

Machine Learning

d) **Related Courses**

Deep Learning Architectures

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Choose the relevant activation function for the given problem.	K3
CO2	Compare the different CNN architectures available in the literature.	K3
CO3	Differentiate CNN from RNN and apply RNN for time sequence problems.	K3
CO4	Develop the test procedures to assess the efficacy of the developed model.	K3
CO5	Apply simple deep learning for object detection and recognition in images.	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	1							2			2		1
CO2	1	1		2						1	1		1
CO3	1	1	1	2	1		2		2		1	1	1
CO4	1	1	1		1						1	1	1
CO5	3	1	1										1

f) Course content

UNIT I INTRODUCTION TO DEEP LEARNING

9

Machine Learning vs Deep Learning, Representation Learning, Width and Depth of Neural Networks, Learning Algorithms: Capacity - Overfitting - Underfitting - Bayesian Classification - Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted and Deep Boltzmann Machines.

UNIT II CONVOLUTIONAL NEURAL NETWORKS

9

Architectural Overview, Motivation, Layers, dropout, Filters, Parameter sharing, Regularization, Popular CNN Architectures: AlexNet, ResNet and UNet – Applications.

UNIT III RECURRENT AND RECUSIVE NETS

9

Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short-Term Memory Networks, Computer Vision - Speech Recognition - Natural language Processing, Case studies in classification, Regression and deep networks.

UNIT IV ADVANCED NEURAL NETWORKS

9

Deep Feedforward Networks: Gradient based learning - Hidden Units - Architectural design – Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustness –Semi supervised learning - Multitask learning - Deep Belief networks - Generative Adversarial Networks by Keras MXnet.

UNIT V APPLICATIONS OF DEEP LEARNING

9

Images segmentation – Object Detection – Automatic Image Captioning - Case Study: Named Entity Recognition – Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

Total 45 Hrs.

g) Learning Resources

Text Books

- [1] Ian Goodfellow, Yoshua Bengio, and Aaron Courville. *Deep Learning*. First Edition, MIT Press, 2016.
- [2] Nikhil Buduma and Nicholas Lacascio. *Fundamentals of Deep Learning*. First Edition, O.Reilly, 2017.

Reference Books

- [1] Josh Patterson, Adam Gibson. *Deep Learning: A Practitioner's Approach*. O'Reilly Media, 2017.
- [2] Laura Graesser, Wah Loon Keng. *Foundations of Deep Reinforcement Learning: Theory and Practice in Python*. Addison-Wesley Professional, 2020.
- [3] Jon Krohn, Grant Beyleveld, Aglaé Bassens. *Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence*, 1st edition Addison-Wesley Professional, 2019.

Course Code	Course Title	L	T	P	C
10212BM110	Natural Language Processing	3	0	0	3

a) Course Category

Major Specialization

b) Preamble

To understand the fundamentals of Natural Language Processing (NLP).

c) Prerequisite

None

d) Related Courses

Machine Learning

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Analyse the given text with basic Language features	K4
CO2	Develop speech recognition using NLP components	K3
CO3	Apply rule-based system to tackle morphology/syntax of a language	K3
CO4	Identify a tag set to be used for statistical processing for real-time applications	K3
CO5	Identify the use of different statistical approaches for different types of NLP applications	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3	1	1	3										2
CO2	3	1	1	3										2
CO3	3	1	1	3										2
CO4	3	2	1	3										2
CO5	3	1	1	3										2

f) Course content

UNIT I SPEECH

9

Speech – Phonetics - Speech Synthesis - Automatic Speech Recognition - Speech Recognition: - Advanced Topics - Computational Phonology

UNIT II INTRODUCTION TO MEDICAL NATURAL LANGUAGE PROCESSING 9

Introduction to Medical Natural Language Processing – Challenges of Big Data in Health – tokenization, normalization – Word sense disambiguation - N-grams - Part-of-Speech – Tagging - Hidden Markov and Maximum Entropy Models.

UNIT III SYNTAX AND TEXT CLASSIFICATION

9

Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity – Decision trees – Support Vector Machines – Naïve Bayes – Tools: Weka

UNIT IV SEMANTICS AND PRAGMATICS

9

The Representation of Meaning - Computational Semantics - Lexical Semantics - Computational Lexical Semantics - Computational Discourse

UNIT V APPLICATIONS

9

Information Extraction - Question Answering and Summarization – Sentiment analysis – Challenges due to acronyms-polysemy, synonymy – Deep Learning

Total 45 Hrs.

h) Learning Resources

Text Books

- [1] Daniel Jurafsky. *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech*. Pearson Publication, 2014.
- [2] Steven Bird, Ewan Klein and Edward Loper. *Natural Language Processing with Python*. First Edition, O'Reilly Media, 2009.
- [3] Cohen, K. B., & Demner-Fushman, D. *Biomedical natural language processing (Vol. 11)*. John Benjamins Publishing Company, 2014.

Reference Books

- [1] Breck Baldwin. *Language Processing with Java and LingPipe Cookbook*. Atlantic Publisher, 2015.
- [2] Richard M Reese. *Natural Language Processing with Java*. O'Reilly Media, 2015.
- [3] Nitin Indurkha and Fred J. Damerau. *Handbook of Natural Language Processing*. Second Edition, Chapman and Hall/CRC Press, 2010.
- [4] Tanveer Siddiqui, U.S. Tiwary. *Natural Language Processing and Information Retrieval*. Oxford University Press, 2008.
- [5] Jurafsky, D. and J. H. Martin. *Speech and language processing: An Introduction to Natural Language Processing*. Computational Linguistics, and Speech Recognition, Prentice-Hall, 2000.

Course Code	Course Title	L	T	P	C
10212BM304	Essential Python Modules for Machine Learning Laboratory	0	0	2	1

a) Course Category

Program Core/ Laboratory

b) Preamble

The objective of the course is to provide students an insight into Python programming, and develop programming skills to manage the development of software systems. It covers programming environments, data representations, Object Oriented Programming. This course lays the foundation to Machine Learning, and Artificial Intelligence-based applications & tools, Data Science and Data Visualization applications.

c) Prerequisite

Python Programming

d) Related Courses

Image Processing, Machine Learning.

e) Course Outcomes

Upon successful completion of the course students will be able to

CO Nos.	Course outcome	Skill Level (Dave's Taxonomy)
1	Write, test and debug python programs and import basic packages.	S2
2	Write programs in python to process data by utilizing the modules Numpy, Pandas etc.	S2
3	Write programs in python for image processing using OpenCV, skimage.	S2
4	Develop and deploy machine learning models using sklearn and tensorflow	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			2								2	

CO2	2	2			2								2	
CO3	1	2	3	1	2			2	2	2			3	
CO4		2			2			2	2	2			3	

LIST OF EXPERIMENTS

1. Implementation of simple python program by installing and exploring python IDE.
2. Import basic packages, libraries and execute programs in python IDE.
3. Write a python program to create and manipulate one-dimensional and two-dimensional numpy arrays.
4. Write a pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.
5. Write a pandas program to join and merge data frames.
6. Write a python program to do basic image processing operations (Histogram equalization, thresholding, edge detection, data augmentation, morphological & geometric operations) using OpenCV.
7. Write a program in python to implement spatial domain filters for image processing using OpenCV
8. Write a python program to convert image array to a new color space using skimage.
9. Write a python program for conversions between one color space to another color space using skimage.
10. Write a python program for data visualization and importing datasets using sklearn.
11. Write a python program involving various classification algorithms to classify the imported dataset using sklearn.
12. Write a python program to develop and deploy machine learning models using tensorflow.

Total: 30 Hrs.

Course Code	Course Title	L	T	P	C
10212BM122	High-Performance Computing	3	0	0	3

a) Course Category

Program Elective

b) Preamble

This course explores the basics of programming for heterogeneous architectures. Also, the course introduces different GPU programming models and the issues in mapping algorithms for GPUs.

c) Prerequisite

C/C++

d) Related Courses

Microprocessor and Microcontrollers, C/C++ programming.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe GPU Architecture	K2
CO2	Write programs using CUDA, considering memory, thread usage & resource contentions	K2
CO3	Explain data movement issues in shared program architecture in HPC	K2
CO4	Work with OpenCL environment	K2
CO5	Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication	K2

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2
CO 1	3	1	1											1
CO 2	3	1	1											1
CO 3	3	1	1											1
CO 4	3	2	1											1
CO 5	3	1	1											1

f) Course content

UNIT I GPU ARCHITECTURE

12

Evolution of GPU architectures – Understanding Parallelism with GPU –Typical GPU Architecture – CUDA Hardware Overview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

UNIT II CUDA PROGRAMMING

8

Using CUDA – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III PROGRAMMING ISSUES

8

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT IV OPENCL BASICS

8

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT V ALGORITHMS ON GPU

9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.

Total 45 Hrs.

g) Learning Resources

Text Books

[1] Shane Cook. *CUDA Programming: —A Developer’s Guide to Parallel Computing with GPUs (Applications of GPU Computing)*. First Edition, Morgan Kaufmann, 2012.

[2] David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang. *Heterogeneous computing with OpenCL*. 3rd Edition, Morgan Kauffman, 2015.

Reference Books

[1] Nicholas Wilt. *CUDA Handbook: A Comprehensive Guide to GPU Programming*, Addison – Wesley, 2013.

[2] Jason Sanders, Edward Kandrot. *CUDA by Example: An Introduction to General Purpose GPU Programming*, Addison – Wesley, 2010.

[3] David B. Kirk, Wen-mei W. Hwu. *Programming Massively Parallel Processors – A Hands-on Approach*. Third Edition, Morgan Kaufmann, 2016.

[4] Accessed on 8 April 2020. Available at: http://www.nvidia.com/object/cuda_home_new.html.

[5] Accessed on: 9th April 2020. Available at: <http://www.openCL.org>

Course Code	Course Title	L	T	P	C
10212BM205	Foundations of Data Science and R	3	0	2	4

a) Course Category

Honors Specialization

b) Preamble

To give insights about the data science, tools for data science and R language

c) Prerequisite

Engineering Mathematics – Linear Algebra

d) Related Courses

None

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Get insights about data, data science basics and data science process	K2
CO2	Use the tools to describe and organize the variability in observed	K3
CO3	Utilize the tools to correlate data and interpret the information	K3
CO4	Get insights about foundations of R, dataset creation; and work with graphs	K3
CO5	Manage data in R	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1		1	1									
CO2	2	2		2	3								1	
CO3	2	2		2	3								1	
CO4	1	1		1	1									
CO5	2	2		2	2								1	

f) Course content

UNIT I Introduction to Data and Data Science

9

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications

UNIT II Describing Data I – Descriptive Statistics

9

Frequency distributions – outliers – relative frequency distributions – cumulative frequency distributions – frequency distributions for nominal data – interpreting distributions – graphs – averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data. Exercise problems.

UNIT III Describing Data II – Descriptive Statistics

9

Normal distributions – z scores – normal curve problems – finding proportions – finding scores – more about z scores – correlation – scatter plots – correlation coefficient for quantitative data – computational formula for correlation coefficient – regression – regression line – least squares regression line – standard error of estimate – interpretation of r^2 – multiple regression equations – regression toward the mean. Exercise problems.

UNIT IV Introducing R, Dataset Creation and Graphs

9

Why use R - obtaining and installing R - working with R - R packages – batch processing - using output as input—reusing results - working with large datasets - Creating a dataset - understanding datasets - data structures – data input - entering and importing data - annotating datasets - useful functions for working with data objects - working with graphs - a simple example - graphical parameters - Adding text, customized axes, and legends - combining graphs

UNIT V Data Management in R

9

Creating new variables – recording and renaming variables – missing values – date values – type conversions – sorting data – merging datasets – subsetting datasets - Numerical and character functions - mathematical, statistical, probability, character, and other useful functions - applying functions to matrices and data frames - Control flow - Repetition and looping, conditional execution - user-written functions - aggregation and restructuring

Total: 45 Hrs.

Practical - Experiments using R

1. Installation of R (Rstudio) and packages (tidyverse - ggplot2, tibble, tidyr, readr, purrr, and dplyr) – Basic Coding Syntax – Running R code
2. Creating matrices, arrays, data frame, and lists
3. Entering and importing data
4. Measures of central tendency and variability
5. Skewness, kurtosis and Correlation
6. Creating – Bar, box and dot plots – Pie charts – Histograms
7. Creating – Kernel density plots, scatter plots and line chart
8. Working with Messy data
9. Writing conditional statements and creating loops
10. SQL and R

Total: 30 hrs

g) Learning Resources

- [1] Davy Cielen, Arno D. B. Meysman, and Mohamed Ali. *Introducing Data Science*. Manning Publications, 2016.
- [2] Robert S. Witte and John S. Witte. *Statistics*. Wiley, Eleventh Edition, 2017 .
- [3] Robert I. Kabacoff. *R in Action - Data analysis and graphics with R*. Manning Publications, 2011.

Reference Resources

- [1] Ivo D. Dinov. *Data Science and Predictive Analytics - Biomedical and Health Applications using R*. Springer, 2018.

[2] Peter Bruce and Andrew Bruce. *Practical Statistics for Data Scientists*. O'Reilly, 2017.

[3] Hadley Wickham and Garrett Grolemund. *R for Data Science - Import, Tidy, Transform, Visualize, and Model Data*. O'Reilly, 2017.

[4] Nina Zumel and John Mount. *Practical Data Science with R*. Manning Publications, Second Edition, 2020.

Web Links

[1] R Fundamentals. Accessed on: 20 April 2020. Available at: <http://becomingvisual.com/rfundamentals/conditionals-controls-functions.html>

[2] R for Data Science . Accessed on: 10 April 2020. Available at: <https://r4ds.had.co.nz/program-intro.html>

[3] Data Science Tutorials. Accessed on: 13 April 2020. Available at: https://www.simplilearn.com/tutorials/data-science-tutorial/linear-regression-in-r?source=sl_frs_nav_playlist_video_clicked

Course Code	Course Title	L	T	P	C
10212BM111	Inferential Analysis and Machine Learning	3	0	0	3

a) **Course Category**
Honors Specialization

b) **Preamble**

c) **Prerequisite**
Foundations of Data Science and R

d) **Related Courses**

e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the fundamentals of probability and inference statistics	K2
CO2	Get insights about the tools that help to generalize the numerical and categorical data	K3
CO3	Prepare data for regression analysis, and estimate and interpret a regression model	K3
CO4	Get insights about machine learning fundamentals and apply supervised learning process for biomedical use	K3
CO5	Apply unsupervised learning process, in machine learning, for biomedical use	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	1	1		2	2									
CO2	2	2		2	3								2	
CO3	2	2		2	2								2	
CO4	2	2	1	2	3								2	
CO5	2	2	1	2	3								2	

f) Course content

UNIT I Probability and Inference Basics

9

Probability - defining probability - conditional probability - sampling from a small population - random variables - continuous distributions - distributions of random variables - normal distribution - evaluating the normal approximation - geometric distribution - binomial distribution - more discrete distributions. Foundations for inference - variability in estimates - confidence intervals - hypothesis testing - examining the central limit theorem - inference for other estimators

UNIT II Inferential Statistics

9

Inference for numerical data - one-sample means with the t-distribution - paired data - difference of two means - power calculations for a difference of means - comparing many means with ANOVA - exercises. Inference for categorical data - inference for a single proportion - difference of two proportions - testing for goodness of fit using chi-square - testing for independence in two-way tables - small sample hypothesis testing for a proportion - randomization test – exercises

UNIT III Regression

9

Introduction to linear regression - line fitting, residuals, and correlation - fitting a line by least squares regression - types of outliers in linear regression - inference for linear regression – exercises, case study – predicting medical expenses using linear regression. Multiple and logistic regression - introduction to multiple regression - model selection - checking model assumptions using graphs - introduction to logistic regression – exercises.

UNIT IV Machine Learning – I

9

Origins of machine learning - how machines learn - data storage, abstraction, generalization, evaluation - machine learning in practice - types of input data, types of machine learning algorithms, matching input data to algorithms - lazy Learning – classification using nearest

neighbors -understanding nearest neighbor classification - the k-NN algorithm - measuring similarity with distance - choosing an appropriate k - preparing data for use with k-NN - why is the k-NN algorithm lazy? – case study – diagnosing breast cancer with the k-NN algorithm.

UNIT V Machine Learning – II

9

Clustering with k-means - understanding clustering - clustering as a machine learning task - the k-means clustering algorithm - using distance to assign and update clusters - choosing the appropriate number of clusters. probabilistic learning - understanding naive Bayes - basic concepts of Bayesian methods -understanding probability - understanding joint probability - computing conditional probability with Bayes' theorem - the naive Bayes algorithm - classification with naive Bayes - the Laplace estimator - using numeric features with naive Bayes – case study – simple medical data mining with the naïve Bayes algorithm.

Total: 45 Hrs.

Learning Resources

- [1] Diez, David M., Christopher D Barr y Mine Çetinkaya-Rundel. *OpenIntro Statistics*. 2015
- [2] Lantz, Brett. *Machine learning with R: expert techniques for predictive modeling*. Packt publishing ltd, 2019.

Reference Resources

- [1] Witte, Robert S., and John S. Witte. *Statistics*. John Wiley & Sons, 2017.
- [2] Dinov, Ivo D. *Data Science and Predictive Analytics*. Springer, Ann Arbor, MI, USA, 2018.
- [3] John D. Kelleher, Brian Mac Namee and Aoife D’Arcy. *Machine Learning for Predictive Data Analytics*. MIT Press, 2015

Web Link

- [1] OpenIntro Statistics. Accessed on: 8 April 2020. Available on: <https://www.openintro.org/book/os/>

[2] Data Analysis and Machine Learning Using R: Biomedical Data-
<https://rpubs.com/thanrajks/med-ana>

Course Code	Course Title	L	T	P	C
10212BM112	Precision Medicine in Chronic Diseases	3	0	0	3

a) **Course Category**

Honors Specialization

b) **Preamble**

c) **Prerequisite**

Foundations of Data Science and R

d) **Related Courses**

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the concept of Precision medicines and Precision healthcare technology	K2
CO2	Explain Epigenetics in Precision medicine	K2
CO3	Apply R language for EHR and Big Data	K3
CO4	Explain the role of Precision medicine in Oncology	K2
CO5	Explain the role of Precision medicine in Cardiovascular Prevention	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		3		3							2		
CO2	2		3		3							2		

CO3	2		3	3								2		
CO4	2		3	3								1		
CO5	2		3	3								1		

f) Course content

Unit I Progress and challenges in Precision medicine

9

Introduction to Precision Medicine - Personalized medicine Vs Precision medicine, Precision medicine in complex chronic disease, Precision medicine initiatives and Programs, The Role of electronic health record data - Small data, Big data and data analytics in precision healthcare technology, Mobile technology and EHRs in personalized healthcare technology, Role of mobile technology in diabetes control and other diseases, Remote patient monitoring.

UNIT II Epigenetics in Precision Medicine

9

Introduction-Genetics-Epigenetics-Biomarkers-Genomics-Proteomics, Epigenetic Biomarkers and in Vitro Diagnostics, Epigenetic Biomarkers-an overview of recent advances, Epigenetics in precision medicine of breast cancer-DNA methylation, -DNA methylation as a biomarker for breast cancer.

UNIT III Big Data in Precision Medicine

9

The Concept of Big Data and the Specificities of Healthcare-Volume, Variety, Velocity, Variability, Veracity, Value, Sources of Data, Big Data Analytical Techniques, Representation of Big data and EHR using R language, Challenges in Big Data Analytics.

UNIT IV Precision Medicine in Oncology

9

Introduction- Definition of Precision Medicine in Oncology,-DNA and RNA Sequencing Techniques, Precision Medicine in Specific Tumors- Lung Cancer, Head and Neck cancers, Blood-Based Biomarkers for the Diagnosis and Prognosis of Cancer ;Importance of Blood-Based Biomarkers – Circulating Proteins as Biomarkers, Circulating Tumor DNA as Biomarkers; Challenges of Precision Oncology

UNIT V Precision Medicine in Cardiovascular Prevention

9

Social Determinants of Health and Cardiovascular Care: A Historical Perspective, Biomarkers-Lipid Biomarkers and Cardiovascular Risk, Cardiac Biomarkers in Hypertension, Cardiac Biomarkers in Aortic Stenosis, Cardiac Biomarkers in Heart Failure, Atherosclerosis Imaging-Proposed Tools for Personalizing Risk Estimation.

Total: 45 Hrs.

Learning Resources

Reference Books

[1] Cerrato, Paul, and John Halamka. *Realizing the promise of precision medicine: the role of patient data, mobile technology, and consumer engagement*. Academic Press, 2017.

[2] Aydogan, Bulent, and James A. Radosevich, eds. "Precision Medicine in Oncology." Wiley Blackwell, 2021

[3] Garcia-Gimenez, Jose Luis, ed. *Epigenetics in Precision Medicine*. Elsevier Science & Technology, 2021.

[4] Martin, Seth S., ed. *Precision Medicine in Cardiovascular Disease Prevention*. Springer, 2021.

Web Links

[1] Springate, David A., Rosa Parisi, Ivan Olier, David Reeves, and Evangelos Kontopantelis. "rEHR: An R package for manipulating and analysing Electronic Health Record data." *PLoS One* 12, no. 2 (2017): e0171784.

Course Code	Course Title	L	T	P	C
10212BM301	Inferential Medical Data Analytics Using R	0	0	4	2

a) **Course Category**

Honors Specialization/Lab

b) **Preamble**

c) **Prerequisite**

Foundations of Data Science and R

d) **Related Courses**

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Skill Level (Dave's Taxonomy)
1	Create a function and Arrays for EHR data in R	S2
2	Perform matrix operations in R	S2
3	Perform Regression and distribution using R	S3
4	Implement ANOVA test and Machine learning	S2
5	Implement Machine Learning classification using R	S3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		3	3	3						2	2		
CO2	2		3	3	3						2	2		
CO3	2		3	3	3						2	2		

CO4	2		3	3	3						2	1		
CO5	2		3	3	3						2	1		

LIST OF EXPERIMENTS

1. a) Creating and Calling R-Function

b) Implementing Matrix operations in R

2. a) Creating Arrays in R

b) Mean, Median and Mode in R language

1. Operation on Linear Regression
2. Operation on Multiple and Logistic Regression
3. Analyzing Normal and Binomial Distribution using R
4. Performing ANOVA test for EHR data in R
5. Supervised Learning for Cancer epidemiological data in R
6. K-NN classifier for an EHR data in R
7. Naïve Bayes Classification for epidemiological data on COVID-19 using R
8. Implementing K-means clustering for an EHR data using R

Total: 60 Hrs

Web Links:

[1] Tutorial point. Accessed on: 5 April 2020. Available on:
<https://www.tutorialspoint.com/r/index.htm>

[2] Introduction to Machine learning in R Accessed on: 6 April 2020. Available on:
<https://www.geeksforgeeks.org/introduction-to-machine-learning-in-r/?ref=lbp>

Course Code	Course Title	L	T	P	C
10212BM113	Predictive Analysis of Medical Data	3	0	0	3

a) **Course Category**

Honors Specialization

b) **Preamble**

c) **Prerequisite**

Inferential Analysis and Machine Learning

d) **Related Courses**

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the concept of supervised learning and kernel classifiers.	K3
CO2	Get knowledge on and will be able to use Decision trees algorithm	K3
CO3	Describe about the decision tree algorithm and will be able to use them for various applications.	K3
CO4	Outline the usage of data in personalized medicine	K2
CO5	Acquire knowledge on the latest available technology for data analysis in healthcare.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2								1	3	3

CO2	3	3	3	2									1	3	3
CO3	3	3	3	2									1	3	3
CO4	3	3	3	2									1	3	3
CO5	3	3	3	2	3								1	3	3

f) Course content

UNIT I Introduction to Supervised Learning and Classifiers

9

Supervised learning - types - Vapnik-Chervonenkis Dimension – Learning multiple classes – Model selection and Generalization – Dimensions of a Supervised machine learning algorithm. SVM - Binary Classification-Classification with Hyperplanes-Multi-class classification-Algorithm implementation to SVM. Case study-prediction of metastasis of colorectal cancer.

UNIT II Decision Trees

9

Decision tree-Divide and conquer-Entropy-Misclassification error and Gini index-C5.0 Decision tree algorithm-Pruning the decision tree-Comparing different impurity indices-Classification rules, case study- Predicting disease and outcome using decision trees-Random Forest classifier, case study- Personalized risk prediction in clinical oncology.

UNIT III Dimensionality Reduction Technique

9

Dimensionality reduction- definition and application- Reducing dimension- Matrix rotation-Notation; Principal Component Analysis (PCA)- Principal Components- using PCA; case study-estimating outcome of biomechanical factors in cutting, automatic recognition of arrhythmia.

UNIT IV Analysis of Healthcare Data

9

Biomedical Image Analysis - Mining of sensor data in healthcare - Biomedical Signal Analysis-Data analytics for Pervasive Health-Fraud detection in healthcare-Data analytics for pharmaceutical discoveries.

UNIT V Applications

9

Genomic Data Analysis for Personalized Medicine, Clinical Prediction model, Predicting models for Integrating clinical and genomic data. Clinical decision support systems-Computer-assisted medical image analysis system-Mobile imaging and analytics of Biomedical Data.

Total: 45 Hrs

Learning Resources

[1] Dinov, Ivo D. "Data Science and Predictive Analytics." *Springer, Ann Arbor, MI, USA* <https://doi.org/10.1007> (2018): 978-3.

[2] John D. Kelleher, Brian Mac Namee and Aoife D'Arcy. *Machine Learning for Predictive Data Analytics*. MIT Press, 2015.

[3] Ethem Alpaydin. *Introduction to Machine Learning*, MIT Press, Third Edition, 2014.

Reference Resources

[1] Campbell, Colin, and Yiming Ying. "Learning with support vector machines." *Synthesis lectures on artificial intelligence and machine learning* 5, no. 1 (2011): 1-95.

[2] Christopher M Bishop. *Pattern Recognition and Machine Learning*. New York: Springer, 2006

[3] Chandan K. Reddy and Charu C Aggarwal. *Healthcare Data Analytics*. Taylor & Francis, 2015.

Course Code	Course Title	L	T	P	C
10212BM114	Healthcare Operations Research	3	0	0	3

a) **Course Category**

Honors Specialization

b) **Preamble**

c) **Prerequisite**

Inferential Analysis and Machine Learning

d) **Related Courses**

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain about the need of Operations research in healthcare	K2
CO2	Analyze a problem and understand the importance of quality.	K2
CO3	Construct models based on various techniques	K2
CO4	Learn about various techniques available and their applications	K2
CO5	Describe and the usage of operations research in medical field	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	3	3	2		2							3	2	1
CO2	3	3	2		2							3	2	1
CO3	3	3	2		2							3	2	1
CO4	3	3	2		2							3	2	1
CO5	3	3	2		2							3	2	1

f) Course content

UNIT I Introduction to Operations Research

9

OR- Definition, history, scope and limitation- Problem-solving and decision-making using OR. Methods-Multi-criteria decision analysis, linear and non-linear programming, discrete-event simulation, queuing and stochastic process modeling, conjoint analysis, neural networking. Process of Operational Research in Healthcare.

UNIT II Performance improvement tools, techniques and programs

9

Problem identification tools- Root-cause analysis, Failure mode and effect analysis, theory of constraints. Analytical tools- Optimization, linear programming, sensitivity analysis, decision analysis. Quality management- Defining quality, cost of quality, Six Sigma. Lean- type of waste.

UNIT III OR Techniques I

9

Techniques: Linear programming-Construction of models, Finding solution, Types, Application in Healthcare; Decision analysis – Decision marketing problems, decision making process, decision making environment, decision under uncertainty, decision under risk, decision tree analysis; Queueing theory – Elements, Characteristics, probability distribution.

UNIT IV OR Techniques II

9

Markov Decision process– Modeling, types of results, modification and extension, application in personalized medicine. Game theory- key concepts, information economics, applications- Incentive design for healthcare providers. Queueing theory- components of Queueing system, queueing models, applications. Network models: PERT/CPM-Advantages, limitations, differences, resource allocation; Demand Forecasting- Qualitative and quantitative approaches.

UNIT V Application in Hospital and healthcare

9

Deceased donor organ allocation system, healthcare supply chain management, POMDP model for personalized breast cancer screening, Subtype based treatment for DLBCL, managing patient flow, improving ambulance operation using simulation.

Total: 45 Hrs

Learning Resources

- [1] Handbook of Healthcare analytics, Tinglong Dai, Sridhar Tayur, Wiley, 2008
- [2] Healthcare Operations Management, Daniel B McLaughlin, Julie M Hays, 2008
- [3] Operations Management in Healthcare, Corinne M Karuppan, Nancy E Dunlap, Michael R Waldrum, Springer, 2016

Reference Resources

- [1] Denton, Brian T. *Handbook of healthcare operations management*. New York: Springer 10, 2013 pp. 9.
- [2] Taha, Hamdy A. *Operations Research: An Introduction/Hamdy*. Arkansas: Prentice Hall, 2011.
- [3] Ramamurthy, P. *Operations Research*. New Age International, 2007.

Course Code	Course Title	L	T	P	C
10213BM110	Neurophysiology	2	0	0	2

a) Course Category

Minor Specialization

b) Preamble

This course will provide the basic functioning of cerebral cortex and its peripherals.

c) Prerequisite

None

d) Related Courses

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the physiology of neural conduction	K2
CO2	Explain the structure and function of cerebral cortex	K2
CO3	Discuss the neural pathway for visual, auditory and proprioceptive stimulus.	K2
CO4	Compare the types of motor controls and feedback	K2
CO5	Discuss the motor control functions	K2

Course content

UNIT-1:Neurons and Neuronal Potentials

10 Hrs

Structure of the neuron - myelinated and non-myelinated, flow of electrical impulse through the nerves, nerve fibres as cables. Nerve impulse - Membrane potential and Action potential, propagation of action potentials, monophasic and biphasic action potentials, threshold - all or none law, refractory period. Neural codes - frequency, spatial, conduction velocity and capacitance. Definitions - Neuromuscular junction, synapses and neurotransmitters.

UNIT 2: Anatomy and Physiology of the cerebral cortex

9 Hrs

Histology, lobes, Cerebral dominance, Brodmann areas. Physiology: Frontal lobe - precentral and prefrontal area, Parietal lobe - somesthetic areas, Temporal lobe- Primary and secondary auditory areas and equilibrium, Occipital lobe - visual area.

UNIT-III: Proprioceptive functions

8 Hrs

Muscle proprioception - spindle, golgi tendon; Joint receptors; Conscious proprioception; Vestibular apparatus.

Temporal coding for low frequency sound, central pathways and responses.

Vision - neural processing

UNIT-IV: Motor control and feedback

8 Hrs

Ballistic, Parametric adjustment, direct feedback, internal feedback, Hierarchy of control, functional characteristics of different levels.

UNIT-V: Motor functions

10 Hrs

Local motor control - sensory feedback from muscles - golgi tendon and muscle spindles - spinal reflex, muscle tone, servo hypothesis, load, servo-assistance. posture control.

Higher motor control - components of voluntary action, Primary motor cortex - cortical influence in spinal cord, somatosensory input and manipulation

Total hrs- 30

REFERENCE BOOK

- [1] Carpenter, Roger, and Benjamin Reddi. *Neurophysiology: a conceptual approach*. CRC Press, 2012.

Course Code	Course Title	L	T	P	C
10213BM111	Introduction to BCI and Signal Acquisition Methods	3	0	0	3

a) Course Category

Minor Specialization

b) Preamble

This course will provide the basic knowledge of types of BCI, brain acquisition modalities and types of brain signal used for BCI applications

c) Prerequisite

Neurophysiology

d) Related Courses

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe about the importance of BCI and the different types of BCI	K2
CO2	Discuss about the Invasive type of BCI signal acquisition and their instrumentation.	K2
CO3	Compare the Non-invasive type of BCI signal acquisition and their instrumentation based on metabolic activity of brain and electric potential from brain	K3
CO4	Discuss about the stimulating the signal for invasive and non-invasive method	K2
CO5	Compare the various brain signals used for BCI application	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1		1			1			1	1	1
CO2	2	1	2	1	2	1		2	1			1	2	1
CO3	2	1	2	1	2	1		1	1			1	2	1
CO4	2	2	2	2	2	2		2	1			1	2	1
CO5	1	1	1	1		1			1			1	1	1

f) Course content

UNIT-I Introduction to BCI

9 Hrs

BCI-definition, objectives, advantage of BCI, BCI Vs neuroprosthetics, BCI components, BCI types: based on recordings-Invasive, non-invasive and semi invasive, BCI that stimulate, bidirectional and recurrent BCI.

UNIT-II Recording of signal Invasive method

6 Hrs

Introduction - Electrode theory and types of electrode, Unipolar and Bipolar Electrodes. Invasive: Microelectrodes, Intracellular Recording, Extracellular Recording, Multielectrode Arrays, Electroencephalography (EEG)-electrode placement, Working principle, Recording setup, Micro ECoG.

UNIT-III Recording of signal Non Invasive method

12 Hrs

Non-Invasive: Electroencephalography (EEG)-EEG-EEG electrodes-10-20 standard system, EEG acquisition-Hardware, EEG rhythms & artifacts, EEG Recording setup; Magnetoencephalography (MEG)-working principle-Recording setup-importance of MEG; Functional Magnetic Resonance Imaging (fMRI)-Principles of FMRI, Recording setup, Imaging techniques, Advantages and disadvantages;, Functional Near Infrared (fNIR) Imaging-working principle & recording setup; PET-working principle & recording setup.

UNIT-IV Stimulating the signal

7 Hrs

Invasive: Microelectrodes, Direct Cortical Electrical Stimulation (DCES), Optical Stimulation

Non-Invasive: Transcranial Magnetic Stimulation (TMS), Transcranial Ultrasound Simultaneous Recording and Stimulation: Multielectrode Arrays, Neurochip. Stimulus design - checkerboard and RSVP

UNIT-V Brain signals for BCI

11 Hrs

BCI using Evoked potential-P300,ODDBALL Paradigm, P300 Origin & function, Amplitude and SSVEP

BCI using sensory motor rhythm-sensory motor behavior,MI movements & slow cortical potential

BCI signals from inside-ECoG & brain metabolic activity-fMRI & fNRI signal

Total: 45 Hrs

g) Learning Resources

- [1] Bastos-Filho, Teodiano Freire. ed. *Introduction to Non-Invasive EEG-Based Brain-Computer Interfaces for Assistive Technologies*. CRC Press, 2020.
- [2] Rao, Rajesh PN. *Brain-computer interfacing: an introduction*. Cambridge University Press, 2013.
- [3] Rashid, Mamunur, Norizam Sulaiman, Anwar PP Abdul Majeed, Rabi Muazu Musa, Bifta Sama Bari, and Sabira Khatun. "Current status, challenges, and possible solutions of EEG-based brain-computer interface: a comprehensive review." *Frontiers in neurorobotics* (2020): 25.
- [4] Webster, John G. "Medical instrumentation-application and design." *Journal of Clinical Engineering* 3, no. 3 (1978): 306.

Course Code	Course Title	L	T	P	C
10213BM112	Digital Signal Processing	3	2	0	4

a) **Course Category**

Minor Specialization

b) **Preamble**

This course provides the basic knowledge on the required mathematics for the process of analog and digital signals

c) **Prerequisite**

Transforms and Partial differential Equations

d) **Related Courses**

Microprocessor and Microcontroller, Image Processing

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Classify the continuous/discrete time signals/systems from the given equation according to their properties	K3
CO2	Compute the spectrum of periodic and aperiodic signals using Continuous and Discrete	K3
CO3	Solve problems on analog to digital signal conversion, Aliasing and identify the signal using Fourier transform	K3
CO4	Design FIR filter for the given specification	K3
CO5	Design IIR filter for the given specification	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO1	2	1	1	1	1							1		1
CO2	2	1	1	1	1							1		1
CO3	2	2	1	1	2							1		1
CO4	2	2	1	1	2							1		1
CO5	2	2	1	1	2							1		1

f) **Course content**

UNIT-I Classification of signals and systems

9+6

Continuous Time signals (CT signals) – Discrete Time signals (DT signals) – Elementary CT signals and DT signals – Basic properties of signals , Classification of CT and DT signals – Basic properties of systems – Classification CT systems and DT systems – Linear time invariant systems and properties

UNIT-II signal and system analysis (CT and DT)

9+6

Fourier Transform in signal analysis and system analysis, convolution integral and impulse response, Fourier transform of discrete sequence, Z-transform and its properties, inverse z-transforms; Stability analysis, frequency response – Convolution..

UNIT-III Representation of discrete time signals and FFT

9+6

Sampling of Continuous Time signals and aliasing –z transform in Discrete Time signal analysis, Discrete Fourier Transform, (DFT), DFT for periodic sequence, Fast Fourier Transform (FFT), Butterfly Diagram, Convolution through FFT

UNIT-IV Design of FIR Filters

9+6

FIR design: Windowing Techniques - Rectangular, Hamming, Hanning – Need and choice of windows – Linear phase characteristics.

UNIT-V Design of IIR Filters

9+6

IIR design: Analog filter design - Butterworth filter design using impulse invariant and bilinear transformation - Warping, prewarping - Frequency transformation..

Total: 75 Hrs

g) **Learning Resources**

Text Books

[1] Haykin. *Signals and Systems*. Khanna Publishers, 2000

[2] Proakis, J. G. and Manolakis, D. G. *Digital Signal Processing Principles, Algorithms and Applications*. Pearson Publishers, 2003

Reference Books

- [1] Ashok Ambardar. *Analog and Digital Signal Processing*. Thomson Learning Inc., 1999.
- [2] Douglas K.Lindner. *Signals and Systems*. McGraw-Hill International, 1999.
- [3] Mithrs S.K. *Digital Signal Processing –A Computer Based Approach*. Tata McGraw Hill Publications, New Delhi, 2001.
- [4] Allan V. Oppenheim. *Signals and Systems*. 2nd edition, Prentice Hall of India Pvt. Ltd, 2004.

Course Code	Course Title	L	T	P	C
10213BM203	BCI Feature Extraction & Translation	3	0	1	4

a) **Course Category**

Minor Specialization

b) **Preamble**

This course provides basic knowledge on the commonly used feature extraction and translation techniques

c) **Prerequisite**

Digital Signal Processing

d) **Related Courses**

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Choose a proper signal conditioning method for BCI input signal	K3
CO2	Determine a proper feature extraction technique for BCI application	K3
CO3	Select a proper Classification method	K4
CO4	Examine the performance of the translational algorithm	K3
CO5	Demonstrate the EEGLAB toolbox for EEG signal analysis	K3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	1			1	1		1	1	

CO2	1	2	1	1	1	1			1	1		1	1	
CO3	1	2	1	1	1	1			1	1		1	1	
CO4	1	2	1	1	2	1			1	1		1	1	
CO5	1	2	1	1	3	1			1	1		1	1	

f) **Course content**

UNIT-I Principles of Signal Processing & Signal Conditioning 12

Analog-To-Digital Conversion-*Sampling, Quantization*, Fourier Analysis, Digital filtering-FIR, IIR.

Frequency-Range Prefiltering, Data Decimation and Normalization, Spatial Filtering-Data-Independent Spatial Filters, Data-Dependent Spatial Filters-Bipolar, Laplacian and common average referencing (CAR), ICA, PCA, CSP, Detection and removal of environmental interference and biological artifacts-50/60-Hz power-line interference, EMG and EOG activities and eye blinks- thresholding, band stop and notch filter

UNIT-II Feature extraction techniques in BCI 10

Time (Temporal) Features- Hjorth Parameters, peak-picking and integration, Correlation and Template-Matching, Frequency (Spectral) Features-Band Power, Fast Fourier Transform, Autoregressive Modelling, Time-Frequency Features (Wavelets), Similarity Features- Phase Locking Value, Coherence, Mahalanobis Distance

UNIT-III Feature conditioning and translation methods in BCI 9

Normalization, Log-Normal Transforms, Feature Smoothing, PCA, ICA

General principles-discriminative model and regression model, variations in the data, supervised and unsupervised learning, Linear models-linear discriminant analysis (LDA), Naïve Bayesian classifiers, support vector machines, Non-linear model-KNN, ANN

UNIT-IV Evaluating Translational Algorithm 8

Measuring performance- Accuracy, confusion matrix, kappa co-efficient, minimizing error versus minimizing complexity, BIT rate, Offline evaluation-cross validation, evaluating specific aspects of translational algorithm

UNIT-V EEGLAB toolbox 6

Dataset management, import data, preprocess data, reject artifacts, extract data epochs, plot data,

Total: 45 Hrs

List of Experiments

1. Design FIR and IIR bandpass filters for filtering in a particular frequency band.
2. Comparison of FIR and IIR filters.
3. Design a spatial filter for extracting the motor imagery features.
4. Removal of biological artifacts/environmental interference.
5. Extract the features using the time-frequency method from the EEG signal
6. Extract the features based on the band power of the signal
7. Topoplot
8. Design LDA classifier for classifying two classes
9. Design KNN classifier for the two-class separation

Total: 30 Hrs

Learning Resources

[1] Wolpaw, Jonathan, and Elizabeth Winter Wolpaw, *ed. Brain–Computer Interfaces: Principles and Practice*, Oxford Academic, 2012. Accessed on: 10 Jan 2020, [doi: 10.1093/acprof:oso/9780195388855.001.0001](https://doi.org/10.1093/acprof:oso/9780195388855.001.0001)

[2] Rao, Rajesh PN. *Brain-computer interfacing: an introduction*. Cambridge University Press, 2013

[3] EEGLAB. Accessed on: 10 March 2020. Available on: [Dataset management - EEGLAB Wiki](#)

Course Code	Course Title	L	T	P	C
10213BM302	BCI Data Analysis with MNE	0	0	2	1

a) **Course Category**

Minor Specialization/Lab

b) **Preamble**

This course provides basic knowledge on the commonly used feature extraction and translation techniques

c) **Prerequisite**

Neurophysiology, Digital Signal Processing

d) **Related Courses**

BCI signal processing

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Skill Level (Dave's Taxonomy)
CO1	Interpret any type of EEG data from any acquisition system	S1
CO2	Extract the data in which required information is present.	S2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	2	3	1			1	1		2	2	1
CO2	2	2	2	3	3	1			1	1		2	2	1

List of Experiments

Cycle-1

S.No	Experiment	Skill Level
1	Study of importing different data – EEG and fNIRS	S1
2	Raw data Structure a) loading continuous data b) Querying raw object	S2
3	Modifying Raw objects a) Selecting, dropping and re ordering channels b) changing name or type c) selection in time domain	S2
4	Extraction of data from raw objects and exporting a) Extracting data by index b) extracting channels by name c) extracting channels by type d) raw.get_data()method e) summary f) exporting and saving	S2

Cycle-2

S.No	Experiment	Skill Level
5	Event Handling a) read or write event from or to the file b) subselect or combine event c) mapping event to description d) plotting events e) event arrays	S2
6	Annotating continuous data a) creating annotations b) operations on annotations objects (overlapping annotations) c) reading or writing annotations from or to a file	S2
7	plotting methods for raw objects a) plot as time series b)plot spectral density c) plot sensor locations and projections	S2

Total Periods: 30

Course Code	Course Title	L	T	P	C
10213BM113	BCI-Applications and Ethics	3	0	0	3

a) **Course Category**

Minor Specialization

b) **Preamble**

This course will provide knowledge on current applications of BCI and the ethics to be followed in designing BCI systems

c) **Prerequisite**

None

d) **Related Courses**

None

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Interpret the importance of evaluating the BCI systems clinically	K2
CO2	Explain how BCI can be applied for rehabilitation	K2
CO3	Explain the applications of BCI in therapy	K2
CO4	Differentiate the medical and non-medical applications of BCI	K2
CO5	Describe the ethics need to be followed for designing practical applications of BCI	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			1	1		2		2	2	2	2	2	2	1

CO2	1	1	2	2	2	3		2	2		1	2	3	1
CO3	1	1	2	2	2	3		2	2		1	2	3	1
CO4	1	1	2	2	2	3		2	2		1	2	3	1
CO5			1	1		1		3	1			1	1	1

f) **Course content**

UNIT-I CLINICAL EVALUATION OF BCI

12

Long term and independent use. BCI users and needs, BCI for home environment-caregivers, evaluating and configuring BCI for home, safety, training caregivers, providing technical support.

UNIT-II BCI FOR RESTORATION APPLICATIONS

10

Sensory Restoration, Motor Restoration, , Communication Restoration, Improving Recovery Of Motor Function - Brain Plasticity And Strategies For Using BCI In Motor Rehabilitation, BCI Controlled Wheelchairs, BCI For Rehabilitation Of Stroke Patients, Case Studies.

UNIT-III THERAPEUTIC APPLICATIONS OF BCI

9

BCI based Feedback As A Possible Therapeutic Tool, reducing seizures, Improving cognitive function, Improving Emotion Processing And Control, Pain Management. Case Studies - healing of phantom pains.

UNIT-IV NON MEDICAL APPLICATIONS OF BCI

8

Web Browsing And Navigating Virtual Worlds, Robotic Avatars, High Throughput Image Search, Lie Detection And Applications In Law, Monitoring Alertness, Estimating Cognitive Load, Education And Learning, Security, Identification, And Authentication, Physical Amplification With Exoskeletons, Mnemonic And Cognitive Amplification, Applications In Space, Gaming And Entertainment, Brain-controlled Art

UNIT-V ETHICAL ISSUES IN BCI

6

Ensuring Quality Of Care, Ensuring Accessibility Of Results, Invasive BCI Research, Studying BCI Use By People With Disabilities - Physical And Psychological Risks- The Risk Of Inappropriate Outputs, Invasion Of Privacy, Deleterious Cns Plasticity, Uncensored Actions, Respect For Persons: Informed Consent. Case Studies

Total: 45 Hrs

REFERENCES

[1] Wolpaw, Jonathan, and Elizabeth Winter Wolpaw, *ed. Brain-Computer Interfaces: Principles and Practice*, Oxford Academic, 2012. Accessed on: 10 Jan 2020, [doi: 10.1093/acprof:oso/9780195388855.001.0001](https://doi.org/10.1093/acprof:oso/9780195388855.001.0001)

[2] Rao, Rajesh PN. *Brain-computer interfacing: an introduction*. Cambridge University Press, 2013.

[3] Hassanien, Aboul Ella, and A. A. Azar. *Brain-computer interfaces*. Switzerland: Springer, 2015.

Course Code	Course Title	L	T	P	C
10213BM303	EEG Recording & Analysis Laboratory	0	0	2	1

a) Course Category

Minor Specialization

b) Preamble

Brain-Computer interface deals with the recording of brain signals and analysis it for interfacing with external devices. This course gives a hands-on for setting up the EEG recording system, acquiring and analysis.

c) Prerequisite

Neurophysiology, Introduction to BCI and Signal Acquisition Methods, Digital Signal Processing

d) Related Courses

None

e) Course Outcomes

Upon successful completion of the course students will be able to

CO. Nos	Course outcome	Skill Level (Dave's Taxonomy)
1	Record the EEG signals using different hardware set up	S2
2	Design the different stimuli for BCI application	S2
3	Demonstrate the analysis of signal using EEGLAB	S3
4	Illustrate the feature component and visualize it using EEGLAB	S2
5	Choose the appropriate channel and output stimulus for a BCI-based application.	S3

f) CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	3		3	3	3		2	3	3
CO2	3	2	2	2	2	2			2			2	3	

CO3	3	2	2	2	2	2			2			2	3	
CO4	2	1	1	1	2				2			1	3	
CO5	3	3	3	3	3	3		3	3	3		2	3	3

LIST OF EXPERIMENTS

1. Hardware set up of EEG acquisition system
 - a) Ganglion board
 - b) Cyton board
2. Hardware set up of EEG acquisition system
 - a) RMS system
3. Recording of signal
 - a) Using Ganglion board
 - b) Using Cyton Board
4. Recording of signal
 - a) Using RMS system
5. Design of Recording setup with stimulus
 - a) Motor imagery
 - b) Motor movement
 - c) Mental arithmetic
 - d) Visual stimulus
6. Import the following using EEGLAB-continuous data, event information, channel locations and
7. Filter the line noise and bandpass filter the EEG data using EEGLAB
8. Remove the bad channels and bad data using EEGLAB
9. Plot the 2D ERP, 3D ERP, Channel spectra, and time-frequency analysis
10. Real-time acquisition of EEG signal by designing an experimental set up and analysis it.

Total: 30 Hrs.

g) Learning Resources

[1] Carpenter, Roger, and Benjamin Reddi. *Neurophysiology: a conceptual approach*. CRC Press, 2012.

[2] Bastos-Filho, Teodiano Freire, ed. *Introduction to Non-Invasive EEG-Based Brain-Computer Interfaces for Assistive Technologies*. CRC Press, 2020.

[3] Rao, Rajesh PN. *Brain-computer interfacing: an introduction*. Cambridge University Press, 2013.

[4] Open BCI. Accessed on: 19 Arp 2018. Available: [OpenBCI | Home](#)

[5] EEGLAB. Accessed on 19 Arp 2018. Available: [Tutorials - EEGLAB Wiki](#)

Course Code	Course Title	L	T	P	C
10213BM201	Bio Signal Processing Instrumentation	2	0	2	3

a) **Course Category**

Open Elective

b) **Preamble**

The course gives hands on experience to build their own simple signal processing medical devices to measure physiological parameters.

c) **Prerequisite**

It is added advantage if you have Microprocessor / C coding Knowledge

d) **Related Courses**

Microprocessor and Microcontrollers

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
1	Write C code for peripheral programming using MSP430	K3
2	Describe the signal acquisition challenges in designing Medical Instruments	K2
3	Build ECG using MSP430 and interpret the waveform	K3
4	Describe the principles of ultrasonic and build simple application	K3
5	Compare the architecture of DSP with Microprocessor	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2	3	3	2	2						1	3

CO2	1	1	2	3	3	2	2						1	3
CO3	1	1	2	3	3	2	2						1	3
CO4	1	1	2	3	3	2	2						1	3
CO5	1	1	2	3	3	2	2						1	3

f) Course Content

UNIT I MSP430G2553

6

16-bit low power MCU MSP430: Introduction to microcontrollers and embedded systems, Von Neumann and Harvard architecture, RISC and CISC machine, Introduction to MSP430: Architecture, Programming Techniques, Addressing Modes, Programming System registers and configuration I/O ports pull up/down registers concepts, Configuring Peripherals in MSP430, interrupt programming, Timer/ counter interrupt, Programming MSP430 timer

UNIT II Components of signal processing Instruments

6

Medical Instruments, Signal Acquisition challenges, Instrumentation amplifier requirement, Analog front end (AFE) for bio potential measurements, Low noise and Low power AFE, Precision voltage references

UNIT III Electrocardiogram

6

Working of heart, ECG waveform, AFE H/W, software flowchart,

UNIT IV Ultrasound Imaging system

6

Basics of ultrasound physics, Basic principle of ultrasound imaging, Ultrasound system block diagram, Ultrasound DAQ, Digital ultrasound beam former, AFE5808A

UNIT V TMS320C5515

6

Architecture difference between Digital signal processor and microprocessor, System Block diagram, CPU core and peripherals, Program and data memory, external and I/O memory map,

30 Hrs.

LIST OF EXPERIMENTS:

30 Hrs.

1. Creating Project using CCStudio for MSP430 board
2. Timer Mode 0 with MSP430
3. Timer Mode 1 with MSP430
4. Demonstration of GPIO interrupt (external button interrupt)
5. ADC programming using polling
6. Interfacing AD8232 with MSP430G2553
7. Ultrasonic distance meter using MSP430G2553
8. ECG simulation using MATLAB

Total: 60 Hrs.

g) Learning Resources
Text Books

1. TMS320C5515 User Guide. Accessed on : 20 Dec 2020. Available: <http://www.ti.com/lit/ug/sprufx5e/sprufx5e.pdf>
2. TI Health Tech Applications Guide. Accessed on: 20 Dec 2020. Available: [TI HealthTech Health Guide \(Rev. A\) \(semice.com\)](#)

Course Code	Course Title	L	T	P	C
10213BM202	Brain Computer Interface	2	0	2	3

- a) **Course Category**
Open Elective
- b) **Preamble**
This course helps to design the brain computer interface system using brain signals.
- c) **Prerequisite**
None
- d) **Related Courses**
Anatomy and Physiology of brain, Signals and systems and Digital signal processing
- e) **Course Outcomes**
Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
1	Discuss in detail about the nervous system	K2
2	Discuss different types of BCI signals from instruments	K2
3	Discuss and compare different types of brain signals used for feature extraction	K2
4	Discuss the major components of BCI which makes up the system	K2
5	Applications of BCI system	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1									2	2	1
CO2	2	1	1									2	2	2

CO3	2	2	1	1	2							1	3	2
CO4	1	1	2	3	3							3	3	1
CO5	1	1	1									2	1	1

f) Course Content

UNIT-I Nervous System

5

Anatomy and Physiology of Brain, Basic cells of the nervous system, functions of the nervous system, Regions of the Brain, Disorders of nervous system.

UNIT-II Brain computer interface

5

Fundamentals of BCI – Structure of BCI system – Classification of BCI: Invasive, Non-invasive and Partially invasive BCI, Brain signal acquisition systems- EEG, MEG, fNIRS, fMRI.

UNIT-III EEG features and stimulus design used in BCI

5

EEG-Temporal characteristics, Spatial Characteristics, Oscillatory EEG activity, event-related potentials (ERP), slow cortical potentials (SCP), and neuronal potentials, Motor Imagery.

UNIT-IV Signal processing of BCI

5

Signal Processing-spatial and time domain, Feature extraction, Machine Learning.

UNIT-V BCI Application

5

Medical Application-Rehabilitation, Brain controlled wheelchair, and Non-medical application-Monitoring Alertness, Gaming and entertainment.

30 Hrs.

LIST OF EXPERIMENTS

30 Hrs.

1. Study and collection of online EEG datasets
2. Study of BCILAB toolbox
3. Designing of filter
4. Analysis of CSP parameters using BCILAB
5. CSP and FBCSP
6. Acquisition of EEG using ganglion board

Total: 60 Hrs.

g) Learning Resources

Reference Books:

- [1] Nicolas-Alonso, Luis Fernando, and Jaime Gomez-Gil. "Brain computer interfaces, a review." *sensors* 12, no. 2 (2012): 1211-1279.

[2] Accessed on: 10 Dec 2019 (<https://scen.ucsd.edu/wiki/BCILAB>)

[3] Lotte, Fabien, and Cuntai Guan. "Spatially regularized common spatial patterns for EEG classification." In *2010 20th International Conference on Pattern Recognition*, pp. 3712-3715. IEEE, 2010.

[4] Fukunaga, Keinosuke. *Introduction to statistical pattern recognition*. Elsevier, 2013.

Course Code	Course Title	L	T	P	C
10213BM101	Body Area Networks	3	0	0	3

a) **Course Category**

Open Elective

b) **Preamble**

This course will help the students to understand about body area networks along with the various hardwares used and their applications.

c) **Prerequisite**

Analog and Digital Communication

d) **Related Courses**

None

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain about working of Body Area Network	K2
CO2	Explain the hardware used for BAN with LAN/WAN	K2
CO3	Explain the wireless communication infrastructure used for BAN.	K2
CO4	Discuss the technical challenges involved in BAN	K2
CO5	Brief on the applications of BAN.	K2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1											1	
CO2	1													
CO3	1													
CO4		1												
CO5	1	2											2	

f) **Course content**

UNIT I INTRODUCTION

9

Definition, BAN and Healthcare, Technical Challenges- Sensor design, biocompatibility, Energy Supply, optimal node placement, number of nodes, System security and reliability, BSN Architecture –Introduction.

UNIT II HARDWARE FOR BAN

9

Processor-Low Power MCUs, Mobile Computing MCUs, Integrated processor with radio transceiver, Memory, Antenna-PCB antenna, Wire antenna, Ceramic antenna, External antenna, Sensor Interface, Power sources- Batteries and fuel cells for sensor nodes.

UNIT III WIRELESS COMMUNICATION AND NETWORK

9

RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand –Alone BAN, Wireless personal Area Network Technologies- IEEE 802.15.1, IEEE P802.15.3, IEEE 802.15.4, Zigbee

UNIT IV COEXISTENCE ISSUES WITH BAN

9

Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self protection-Bacterial attacks, Virus infection ,Secured protocols, Self protection.

UNIT V APPLICATIONS OF BAN

9

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhythmia monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

Total: 45 Hrs.

g) Learning Resources

Text Books

- [1] Annalisa Bonfiglio, Danilo De Rossi. *Wearable Monitoring Systems*. Springer, 2011.
- [2] Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar V. *Body Area Networks Safety, Security, and Sustainability*. Cambridge University Press, 2013.
- [3] Guang-Zhong Yang. *Body Sensor Networks*. Springer, 2006

Course Code	Course Title	L	T	P	C
10213BM102	Environmental Conservation	3	0	0	3

a) **Course Category**

Open Elective

b) **Preamble**

To provide a basic understanding of occupancy of the ecosystem in line with Biodiversity. Its conservative measures taken by the agencies as well as the federal Government.

c) **Prerequisite**

None

d) **Related Courses**

None

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Illustrate the elements and types of biodiversity.	K2
CO2	Contrast the threats and damages to biodiversity.	K2
CO3	Classify the bio diversity conservation and protection measures.	K2
CO4	Outline the sustainable management of bio diversity.	K2
CO5	Summarize the legal aspects for environmental conservation.	K2

CO PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

Status and protection of species in National and International levels – Role of CITES and IUCN – Convention on Biological Diversity (CBD) – Nagoya Protocol – Man and Biosphere Programme (MAB) – Policies implemented by MoEF for biodiversity conservation – Salient features of Biological Diversity Act 2002.

TOTAL: 45 Periods

g) Learning Resources:

a) Text Books:

[1] Chaudhuri A.B. and Sarkar D.D.. *Mega diversity Conservation: Flora, Fauna and Medicinal Plants of India's Hot Spots*. Daya Publishing House, New Delhi, 2003.

[2] Dadhich L.K. and Sharma A.P. *Biodiversity: Strategies for Conservation*. APH Publishing Corporation, New Delhi, 2002.

b) References:

[1] Gary K.M. and Ronald Carroll C. *Principles of Conservation Biology*. Sinauer Associates Inc. Massachusetts, 1994.

[2] Groombridge B. Ed. *Global Biodiversity Status of the Earths Living Resources*. Chapman & Hall, London, 1992.

[3] Khan T.I., Dhari N. and Al. Ajmi. *Global Biodiversity: Conservation Measure*. Pointer Publishers, Jaipur 1999.

Course Code	Course Title	L	T	P	C
10213BM103	Telehealth Technology	3	0	0	3

a. Course Category

Open Elective

b. Preamble

This course helps the students to learn about the E Healthcare with their standards. Also this course gives the detail information about the security, transmission, and storage

c. Prerequisite

None

d. Related Courses

None

e. Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the basic principles of healthcare in telemedicine.	K2
CO2	Compare the different types of communication and networks	K2
CO3	Solve the ethical & legal issues involved in telemedicine.	K3
CO4	Apply the different types of data storage and communication standards used in telehealth system.	K3
CO5	Discuss the various applications of telemedicine.	K2

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			2								
CO2	3		1			3								

CO3	1		1			1								
CO4	3		1			3								
CO5	3		1			3								

f. Course content

UNIT I History and Fundamentals of Telemedicine 9

History and Evolution of telemedicine, definition of telemedicine, Functional diagram of telemedicine system, Telemedicine, Tele health, Tele care, benefits & limitations of telemedicine, Introduction of Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

UNIT II Communication & Network 9

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN, POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Amplitude Modulation (Qualitative Analysis), Communication infrastructure for telemedicine – LAN and WAN technology.

UNIT III Ethical and legal aspects of Telemedicine 9

Ethical and legal aspects of Telemedicine (Case study) - Confidentiality, Social and legal issues (Case Study), Safety and regulatory issues (Case Study), the patient-doctor relationship, access to medical records, consent treatment - data protection & security.

UNIT IV Picture Archiving and Communication System 9

Types of image formats, DICOM standard, PACS system: Block diagram, Storing & retrieving images, Algorithm for retrieving images, Compressions and its significance, Lossless data Storage and in-house communication.

UNIT V Applications of Telemedicine 9

Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery, Health care.

Total: 45 Hrs.

g. Learning Resources

Textbooks

[1] Olga Ferrer-Roca, M.Sosa Ludicissa. *Handbook of Telemedicine*. IOS press, 2002.

[2] Norris A.C. *Essentials of Telemedicine and Telecare*. John Wiley & Sons, 2002.

[3] Wootton R, Craig J, Patterson. *Introduction to Telemedicine*, Royal Society of Medicine Press Ltd., 2nd ed., 2006.

References Books:

[1] Maheu M.M, Whitten P, Allen A. *E-Health, Telehealth, and Telemedicine*. Jossy-Bass, 2001.

[2] Keith J, Dreyer, David S, Hirschorn, James Thrall H, Amit Mehta. *PACS: A Guide to the Digital Revolution*. 2nd Edition, Springer, 2006.

[3] Huang H K. *PACS and imaging informatics – Basic Principles & application*. Wiley Blackwell, 2019.

[4] Latifi R. *Current Principles and Practices of Telemedicine and e-Health*. Washington DC: IOHS, 2008.

[5] Bashshur R L, Shannon G W. *History of Telemedicine*. New Rochelle. NY, Mary Ann Liebert Publishers, 2009.

Course Code	Course Title	L	T	P	C
10213BM104	Medical Instrumentation	3	0	0	3

a) Course Category

Open Elective

b) Preamble

To make the student to acquire knowledge on how to record and measure bio signals and to design bio amplifiers.

c) Prerequisite

Basic Electronics Engineering

d) Related Courses

Sensors and Transducers

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Compare the different types of electrodes and draw its equivalent circuit.	K2
CO2	Explain how to record the various bio signals.	K2
CO3	Design amplifiers used for measuring biosignals.	K3
CO4	Explain how Bio chemical parameters are measured using bioanalytical instruments	K2
CO5	Explain the importance of Patient safety	K2

g) Course content

UNIT I BIO POTENTIAL ELECTRODES

9

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode-skin interface, half cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.

UNIT II ELECTRODE CONFIGURATIONS FOR BIO SIGNAL RECORDING

9

ECG: origin, waveforms and their characteristics, Einthoven triangle – 12 lead configurations, EEG : origin, waveforms and their characteristics, 10-20 electrode placement system – unipolar and bipolar mode. EMG, ERG, EOG – unipolar and bipolar modes.

UNIT III BIO AMPLIFIERS

9

Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference.

UNIT IV BIO ANALITICAL EQUIPMENTS

9

Blood cell counters –microscopic method, coulter counter, Selective ion electrodes, ion analyzer. pH, pco₂, po₂, - calorimeter, spectrophotometer, flame photometer. Autoanalyser

UNIT V ELECTRICAL SAFETY

9

Physiological effects of electricity, susceptibility parameters, Distribution of Electrical of Electric power. Macro shock hazards, micro shock hazards. Protection – power distribution, equipment design. Testing – electrical system and appliances. safety codes for electro medical equipment, electrical safety analyzer.

Total 45 Hrs.

i) Learning Resources

Text Books

- [1] Webster, John G. ed. *Medical instrumentation: application and design*. John Wiley & Sons, 2009.
- [2] Khandpur, R. S. *Hand Book of Biomedical Instrumentation*. Tata Mc Graw Hill publication. New Delhi, 2003.

Reference Books

- [1] Leslie Cromwell. *Biomedical Instrumentation and measurement*. Prentice hall of India. New Delhi, 2007.
- [2] Myer Kutz. *Standard Handbook of Biomedical Engineering and Design*. McGraw Hill Publisher, 2003.
- [3] Joseph J. Carr and John M. Brown. *Introduction to Biomedical Equipment Technology*. Pearson Education, 2004.

Course Code	Course Title	L	T	P	C
10213BM105	Drones in Healthcare	3	0	0	3

a) Course Category

Open Elective

b) Preamble

This course makes the learner to understand limitations, challenges and reasons for using drones in healthcare. Also, the course explores real-world deployments and cost benefit analysis of medical cargo drones.

c) Prerequisite

None

d) Related Courses

Drone Technology.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the challenges and reasons for using drones in healthcare.	K2
CO2	Explain the technical challenges in the use of cargo drones in public health.	K2
CO3	Brief a real-world deployments of cargo drones.	K2
CO4	Explain the regulations and cost benefit analysis of medical cargo drones.	K2
CO5	Explain the drone technologies and its limitations.	K2

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2
CO 1	H	L	L											L
CO 2	H	L	L											L
CO 3	H	L	L											L
CO 4	H	M	L											L
CO 5	H	L	L											L

f) Course content

UNIT – 1 Drones in Public Health

Introduction – Need for Drones in public health – Challenges – Empirical reasons for using drones in public health – push versus pull supply chain systems.

UNIT – 2 Cargo Drone Technologies and Challenges

Types of cargo drone technologies used in public health – Performance parameters and costs of cargo drone technologies – Technical challenges in the use of cargo drones in public health – public health use-cases for cargo drones – stability of samples during cargo drone transportation.

UNIT – 3 Real world deployments

Real world deployments of cargo drones across countries - selecting appropriate cargo drone solutions – vetting and selecting cargo drone companies - selecting appropriate cargo boxes – selecting takeoff and landing sites – standard operating procedures and checklists – hybrid cargo drone models – weather considerations

UNIT – 4 Regulations and Cost Benefit Analysis of Medical Cargo Drones

Aviation and medical regulations – Unmanned Traffic Management (UTM) systems - Estimating the cost of cargo drone deliveries - Cost savings and performance improvements - Selecting the right transportation solution - Cargo drone cost calculator.

UNIT – 5 Health Robotics

Supply chains, drone technologies and limitations – recent medical drone deployments in countries – delivery drones and Covid-19 – Impacts of pandemic in drone regulations

Total 45 Hrs.

g) Learning Resources

Text Books:

[1] J. C. Dauer, *Automated Low-altitude Air Delivery: Towards Autonomous Cargo Transportation with Drones*. Springer Nature, 2021.

[2] S. Bradley , *Medical Drones (World of Drones)*. ReferencePoint Press, Inc. , 2021.

[3] B. Anbaroğlu, Drones in healthcare: An extended discussion on humanitarian logistics. In *Research Anthology on Reliability and Safety in Aviation Systems, Spacecraft, and Air Transport*, IGI Global, 2021, pp. 973-994.

Reference Books:

[1] J. C. Fancher. *Drones for Medical Supplies*. Worcester Polytechnic Institute, 2017. Accessed on: 21 Jul , 2022. Available: [Student Work | Drones for Medical Supplies | ID: jm214q935 | Digital WPI](#)

[2] L. John Hakala. *How Drones Will Impact Society*. San Diego: ReferencePoint, 2018.

[3] Kathryn Hulick. *How Robotics Is Changing the World*. San Diego: ReferencePoint, 2019.

Course code	Course Title	L	T	P	C
10213BM301	BIOMEDICAL LABORATORY	0	0	2	1

Course category

Open Elective

Preamble

Biomedical engineering deals with human physiological parameters. This course gives a hands on for understanding basic anatomy and measurement of a few vital signs

Prerequisite

None

Related Courses

Biology for Engineers

Course Outcomes

Upon successful completion of the course students will be able to

S.No	Course outcome	Skill Level (Dave's Taxonomy)
1	Explain the arrangement of human body to execute normal functions	S1
2	Measure a few vital parameters	S2

Course Contents

List of Experiments

1. Study of body organization – cavities and organs
2. Visualization of cell using microscope
3. Blood group test
4. Bleeding and clotting time
5. Hearing loss test
6. Measurement of Blood pressure

7. Recording of ECG
8. Visual test and Eye anatomy.

Total Periods: 30



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

MINUTES OF
24th BOARD OF STUDIES MEETING

on

17-09-2022

at

10.30AM

held in

CASA LAB

DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF MECHANICAL AND CONSTRUCTION



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

School of Mechanical & Construction
Department of Civil Engineering
24th Board of Studies Meeting of Civil Engineering
17th SEP 2022 @ 10.30a.m.

Ref:-Civil/BOS-24/Agenda/2022

Agenda No.

Agenda

OPENING

- 24BoS01 To confirm the minutes of meeting of the 23rdBOS, held on 25.02.2022
- 24BoS02 Action taken report on Minutes of 23rdBOS meeting
- 24BoS03 Torecordleave of Absence of members

ITEMS FOR CONSIDERATION AND APPROVAL

- 24BoS04 MOOC Courses (NPTEL) recommended under self-learning courses for UG (7.2.7.1) &PG (7.2.4.1) Program for the Summer Semester 2022–23
- 24BoS05 Syllabusfornew courses under the category of programme Core for “VTR UGE 2021”.
- 24BoS06 Syllabusfornew courses under the category of programme Elective for “VTR UGE 2021”.

ITEMS FOR DISCUSSION AND RATIFICATION

- 24BoS07 List of Allied &Institute Elective Courses offered under VTUR15section 7.2.4 & 7.2.5 for the winter Semester of AY 2021-22
- 24BoS08 Value Education Elective offered under VTUR15section 7.2.6 for the Winter Semester of AY 2021-2022

ITEMS FOR REPORTING AND RECORDING

- 24 BoS09 Students awarded credits for independent learning–MOOC Courses under VTUR15 7.2.7.1 for UG winter Semester of AY 2021-22 & underVTUR16 7.2.4.1 for PG winter Semester of AY 2021-22
- 24 BoS10 Students awarded credits for independent learning- Seminar under VTUR15 Sec.7.2.7.2 Winter Semester of AY 2021–22
- 24 BoS11 Students awarded credits for independent learning -Major Project underVTUR15 Sec.7.2.7.2 Winter Semester of AY2021–22
- 24BoS 12 Students awarded credits for independent learning - In-plant Training under VTUR15Sec.7.2.8.2 and 8.3.8 Winter semester of AY 2021-2022
- 24 BoS13 Courses offered by Industry/Higher Learning Institute Interaction – Specialized Courses Under VTUR15 Section 7.2.8.3 Winter Semester of AY 2021-2022
- 24 BoS14 Results of End Semester Examinations –Summer and Winter Semester of AY 2021 -2022
- 24 BoS15 Any other points

Attendance

Sl.No	Name	Designation	Remarks
1.	Dr. GEETHA SELVARANI. A.	Chairman – BOS, Professor &HOD/Civil	Attended
External Members			
2.	Dr.SENTHIL SELVAN. S.	Professor, Department of Civil Engineering, Faculty of Engineering and Technology, Kattankulathur Campus, SRM Institute of Science and Technology.	Attended
3.	Er. SURESH KUMAR. L.	Assistant Engineer,Central Public Works Department.	Attended
Internal Members			
4.	Dr. SAMSON. S.	Professor	Attended
5.	Dr.ASWIN SIDHAARTH. K.R.	Assoc. Professor	Attended
6.	Dr.KUMAR. G.	Assoc. Professor	Attended
7.	Dr.VINODKUMAR. M.	Assoc. Professor	Attended
8.	Dr. KANDASAMY. S.	Assoc. Professor	Attended
9.	Dr. LOGESHWARI. J.	Asst. Professor	Attended
10.	Dr. TAMILARASAN. K.	Asst. Professor	Attended
11.	Dr. SELVAKUMAR. S.	Asst. Professor	Not Attended
Alumni and Student Representative			
12.	Mr.KUSHAL KUMAR	Alumni	Not Attended
13.	Mr.DINESH SHARMA GURUMAYUM – VTU16911	Student Representative	Attended

Welcome Address: Chairman – BOS, welcomed the Special invitees and other members for the 23rd BOS meeting.

Agenda 24.01 : **Confirmation of the Minutes of Meeting of 23rd BOS held on 25.02.2022.**

Discussion : Chairman – BOS, presented the minutes of the 23rd BOS held on 25.02.2022.

Action

: The members confirmed the minutes of the 23rd BOS meeting.

Agenda 23.02 : **To review the Action Taken report on the Minutes of 23rd BOS Meeting.**

Discussion : Chairman – BOS, highlighted the follow-up action taken on the suggestions given by the expert members. These are:

S.No	Points Discussed	Action Taken
1	By inclusion of special structures in the course content, the course name Earth science and infrastructure is renamed as Earth Science for Special Infrastructure. Some genuine contents need to be added which may be related to soil report, importance of structural component in soil and case studies.	Necessary changes have incorporated in the course 10212CE126 - Earth Science for Special Infrastructure under Specialized course in Computer Aided Infrastructure Engineering.
2	Software applications are linked to the course with retrofitting or strengthening of structures. A brief introduction about software to be added in the course.	Necessary changes have incorporated in the course 10212CE127 - Composite Materials for Construction under Specialized course in Computer Aided Infrastructure Engineering.
3	Structural Components with its connections and vortex shedding are to be added in the course. Title of the course is to be revised as Tall Buildings.	Necessary changes have incorporated in the course 10212CE129 - Tall Buildings under Specialized course in Computer Aided Infrastructure Engineering
4	Content such as cable suspension and cable stay, bow string bridge, cantilever bridge concepts and design principles are to be added in Unit III and also suggested that Unit II title is to be renamed as “Design of	Necessary changes have incorporated in the course 10212CE130 - Design of Bridges under Specialized course in Computer Aided Infrastructure Engineering.

	shortspan bridges”	
5	Top down & bottom up methods, metro tunnelling & construction techniques, safety aspects to be included in the course. Unit IV & V contents have to be merged with relevance.	Necessary changes have carried out in the course 10212CE131 - Tunnel Engineering under Specialized course in Computer Aided Infrastructure Engineering.
6	Terminology and applications of IOT to be added in the course. Minor/Major projects are to be included and its link to the other course.	Necessary changes have incorporated in the course 10212CE135 - Internet of Things for Civil Engineering.
7	Some of the topics in Unit III and Unit V are to be added/reduced. Text books 1 and 2 are to be removed.	Necessary changes are carried out by additions, removal and those would be included in 10212CE137 - Industrial Infrastructures under Honors in Infrastructure Engineering.
8	Role of government agencies to be updated in the course. Students have encouraged to go for industrial visit and guest lectures to be arranged for them	Necessary changes have incorporated in the course 10212CE141 - Disaster Management and Mitigation under Honors in Infrastructure Engineering. Information has been given to both industrial visit and guest lecture coordinators to make necessary arrangements.
9	Theory Course category to be changed as Laboratory course in the open elective.	Necessary changes are carried out as changed laboratory course and those would be included in 10213CE114 - Open-Source Software For GIS – QGIS.

Action : Members gone through the action taken report and approved the same.

Agenda 24.03 : **To record leave of absence of members.**

Discussion : BOS member Dr.Selvakumar, Assistant Professor and our Alumni Mr.Kushal Kumar both are absent in view of academic and personal constrain, remaining members all are present sent

Action : The BOS members accepted and the same was recorded.

ITEMS FOR CONSIDERATION AND APPROVAL

Agenda 24.04

:MOOCCourses(NPTEL)recommendedunder self-learning courses for UG(7.2.7.1)&PG(7.2.4.1) Programme for the Summer Semester 2022-23

Discussion

: The Chairman – BoS listed the Self-Learning courses to be offered through NPTEL Platform, under MOOC option, for completing the Independent Learning category, during the Academic Year: 2021-2022 (Winter).

Refer: Annexure : 1

Action

: Members accepted and recommended the different courses and their corresponding credits for the forth coming semester.

Agenda 24.05

: Syllabus for new courses under the category of Programme Core for “VTU UGE 2021”.

Discussion

: Chairman – BOS, presented the syllabus for new courses under the category of Programme Core for “VTR UGE 2021”.

1. In order to offer the appropriate prerequisite under Programme Core category and certain constraint to offer the course entitled Engineering Mechanics in first year second semester duration, in this circumstance the contents pertaining to the courses such as Engineering Mechanics, Mechanics of Solids and Strength of Materials have appropriately structured and offered as Strength of Materials I and Strength of Materials II under Programme Core Category and its advanced contents are framed and offered as Advanced Strength of Materials under Programme Elective Category. It has been maintained that all the contents of these courses are offered under different title and in different categories. The BOS Members have approved the contents of the above said courses and appreciated the same after conforming that the contents of the above courses match the requirement of syllabi of GATE and UPSC.
2. The industrial expert of BOS committee, Er. L. Suresh Kumar has suggested that revise the title of Unit III from the Strength materials II as “Columns and Thick Cylinders” instead of “Column”

3. As per requirement from the industry and to make the students fit to face practical tasks, the BOS Committee members have suggested to move the course “Repair and Rehabilitation of Structures” to Programme Core category from Programme Elective in 22nd BOS Meeting. The content of the course has already approved by the board members in 22nd BOS Meeting. Hence the above course is moved to the category Programme Core.
4. A New Elective course, “Finite Element Method and Modelling” is introduced under the category of Programme Elective.
5. The number of courses available under the Programme Core have maintained and one more additional course is introduced in the Programme Elective Category.

The revised courses under Programme Core category are listed in the table below.

Revised Programme Core Courses in Civil Engineering		
S.No	Course	Credits
1	Strength of Materials I	3
2	Strength of Materials II	3
3	Repair and Rehabilitation of Structures	3

Refer: Annexure 1

Action : The BOS Members recommendations and suggestions in the Syllabus of new courses under the category of Programme Core for “VTR UGE 2021” will be included.

Agenda 24.06 : Syllabus for New Courses under the category of Programme Elective for “VTU UGE 2021”.

Discussion : Chairman – BOS, presented the syllabus for new courses under the category of Programme Elective for “VTR UGE 2021”.

Syllabus for new courses under the category of Programme Elective

New Programme Elective Courses in Civil Engineering		
S.No	Course	Credit

1	Finite Element Method and Modelling	3
2	Advanced Strength of Materials	3
3	Environmental Management System	3
4	Rock Engineering	3
4	Failure Assessment and Rehabilitation of Structures	3
5	Remote Sensing and GIS in Transportation Development	3

Refer: Annexure 2

The BOS Members have suggested including the significant points in the content of the specialized courses are summarized below.

Finite Element Method and Modeling

Dr. S.SenthilSelvan (Academic Expert) suggested to include “Strength of Materials II” as prerequisite course.

Er. L. Suresh Kumar (Industrial Expert) has recommended that to include the 2D ETABS Software tool as the course content and also advised to procure low cost ETABS Software Version for educational institution.

Advanced Strength of Materials

Er. L. Suresh Kumar (Industrial Expert) has recommended to include the topics related to the light weight steel structures in Unit III.

Environmental Management System

Er. L. Suresh Kumar (Industrial Expert) has suggested to

- Mention specific Case Studies to be added for Unit IV and V (e.g.: Life Cycle Assessment (LCA) of concrete, Electronic waste disposal and cement production etc. in each unit).
- Environmental Impact Assessment (EIA) Case Study to be added in the course content.

Rock Engineering

Er. L. Suresh Kumar (Industrial Expert) has suggested to add relevant content with recent topics and to add more sub topics in Unit V.

Failure Assessment and Rehabilitation of Structures

Dr. S.SenthilSelvan (Academic Expert) has recommended to revise the title as “Failure Assessment of Structures” instead of “Failure Assessment and Rehabilitation of Structures” and also suggested to avoid repetition.

Er. L. Suresh Kumar (Industrial Expert) has suggested to include each category of failure such as fire, settlement, seismic effects, design errors and executional errors under each unit of the course with appropriate case studies in each unit.

Remote Sensing and GIS in Transportation Development

Er. L. Suresh Kumar (Industrial Expert) has suggested to interchange the Unit III and Unit IV. Also, recommended that to rename the title of Unit III as **Application of RS & GIS to Transportation** and Unit V as **Advanced Applications in Transportation**.

In addition, the board members have suggested to add recent contents related to modern transportation to be added in Unit V.

Action : The BOS Members recommendations and suggestions in the Syllabus of new courses under the category of Programme Elective for “VTR UGE 2021” will be included.

ITEMS FOR DISCUSSION AND RATIFICATION

Agenda 24.07 : **List of Allied & Institute Elective Courses offered under section 7.2.4 & 7.2.5 for the Winter Semester of AY 2021-22**

Discussion : The Chairman – BOS presented the list of Allied & Institute Elective Courses offered under section 7.2.4 & 7.2.5 for the Winter Semester of AY 2021-22.

The course offered under Allied Elective during 2021-22 (Winter) is given as below.

Course Details					No. of Students Registered
Code	Course	L	T	P	

1153CE105	Air Pollution Management	3	0	0	3	23
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The course offered under Institute Elective during 2021-22 (winter) are given as below.

Course Details						No. of Students Registered
Code	Course	L	T	P	C	
1154CE103	Construction Contracts	3	0	0	3	15
1154CE104	Building Materials	3	0	0	3	22
1154CE105	Construction Engineering	3	0	0	3	12
1154CE107	Startup Essentials	3	0	0	3	09
1154CE108	Application of Remote Sensing and GIS in Disaster Management	3	0	0	3	20
1154CE106	Green Technology and Smart Buildings	3	0	0	3	12

Action : Members have noted and ratified.

Agenda 24.08 : Value Education Elective offered under VTUR15section 7.2.6 for the Winter Semester of AY 2021-2022

Discussion : The Chairman – BOS presented the Value Education Elective Courses offered under section 7.2.6 for the Winter Semester of AY 2021-22.

Course Code	Course Name	No. of Students Registered	No. of Students Eligible	No. of students passed
1155CE102	Behaviour for Innovation	71	71	68

Refer: Annexure 4

Action : Members have noted and ratified.

ITEMS FOR REPORTING AND RECORDING

Agenda 24.09 : Students awarded credits for independent learning – MOOC Courses under VTUR15 7.2.7.1 for UG Winter Semester of AY 2021-22 & under VTUR167.2.4.1 for PG Winter Semester of AY 2021-22

Discussion : The Chairman – BOS presented the list of MOOC Courses recommended under Self-learning courses for UG and PG Program during the winter semester 2021-22

Refer: Annexure 5

Action : Members approved the different courses and the corresponding credits earned by the students.

Agenda 24.10 : Students awarded credits for independent learning - Seminar under VTUR15 Sec.7.2.7.2 in Winter Semester of AY 2021 – 22

Discussion : The Chairman – BOS presented the list of Students awarded credits for independent learning – Seminar I & II under VTUR15 Sec.7.2.7.2 in Winter Semester of AY 2021 – 22

Refer: Annexure 6

Action : Members approved the corresponding credits earned by the students.

Agenda 24.11 : Students awarded credits for independent learning – Major Project under VTUR15 Sec.7.2.7.2 Winter Semester of AY 2021–22

Discussion : The Chairman – BOS presented the list of Students awarded credits for independent learning – Major Project under VTUR15 Sec.7.2.7.2 Winter Semester of AY 2021–22

Refer: Annexure 7

Action : Members approved the corresponding credits earned by the students.

Agenda 24.12 : Students awarded credits for independent learning - In-plant Training under VTUR15 Sec.7.2.8.2 and 8.3.8 winter semester of AY 2021-2022

Discussion : The Chairman – BOS presented the list of Students awarded credits for independent learning – In-plant Training under VTUR15 Sec.7.2.8.2 and 8.3.8

winter semester of AY 2021-2022.

Refer: Annexure 8

Action : Members approved the corresponding credits earned by the students.

Agenda 23.13 : Courses offered by Industry/Higher Learning Institute Interaction Specialized Courses under VTUR15 Section 7.2.8.3 Winter Semester of AY 2021-2022

Discussion : The Chairman – BOS presented the list of Students awarded credits for Courses offered by Industry/Higher Learning Institute Interaction Specialized Courses under VTUR15 Section 7.2.8.3 Winter Semester of AY 2021-2022

Industry/Higher Learning Institute Interaction – Specialized Courses

Course Code	Course Name	Name of the Resource Person	No. of Students Registered	No. of Students Eligible	No. of Students passed
1157CE924	Latest Trends in Construction	Prof. Dr. Fan Su-Ling Tamkang University, Taiwan	61	61	61
1157CE925	Cost Estimation and Quantity Surveying	Dr. Sharifah Ahmad USM, Malaysia	21	20	19
1157CE926	Advanced/Modern Surveying Techniques	Dr. Abdul Hakim Salleh, USM, Malaysia	34	30	30

Refer: Annexure 9

Action : Members approved the corresponding credits earned by the students.

Agenda 23.14 : Results of End Semester Examinations – Summer & Winter Semester of AY 2021-2022

Discussion : The End Semester examination results of December & May 2022 were discussed

Refer: Annexure 10

Action : Members approved and recorded.

Agenda 23.15 : Any other Points

Discussion : NIL

Action : NIL

FEEDBACK AND SUGGESTIONS FROM THE ALUMNI

Discussion : Mr.Dinesh Sharma Gurumayum, third year student, suggested to add more number of case studies in programme elective category,so that students can understand the technology in theoretical approach oftenly Further who has recommended to offer more projects and activities for demonstration oriented lecture delivery with industrial experts. To create awareness about the ethical behaviour among the students Dr.SENTHIL SELVAN. S. Academic expert suggested to conduct the course named Behavioural science of Ethics in value Education Elective Category

Action : Members appreciated and agreed to incorporate their suggestions

Meeting ended with a Vote of thanks proposed by Dr.S. Samson,Professor, Department of Civil Engineering.

Submitted to Vice-Chancellor for approval

Dr.A. GeethaSelvarani – Chairman, BOS.

ANNEXURE – 1

Self-Learning courses taken by students through NPTEL Platform, under MOOC option, for completing the Independent Learning category, during the Academic Year: 2022-2023 (Summer)

S. No	Name of the Course	Course Code	Course Offering Institution	Number of Weeks	Recommended Credits
1	Earth Sciences for Civil Engineering Part – I & II	1156CE418	IIT Kanpur	8 Weeks	2
2	Remote Sensing and GIS	1156CE446	IIT Guwahati	8 Weeks	2
3	GPS Surveying	1156CE406	IIT Roorkee	4 Weeks	1
4	Housing Policy & Planning	1156CE407	IIT Roorkee	8 Weeks	2
5	Project Planning and Control	1156CE434	IIT Madras	8 Weeks	2
6	Principles and Applications of Building Science	1156CE413	IIT Roorkee	4 Weeks	1
7	Plastic Waste Management	1156CE419	IIT Kharagpur	8 Weeks	2
8	Design of Connections in Steel Structures	1156CE416	IIT Hyderabad	4 Weeks	1
9	Reinforced Concrete Road Bridges	1156CE417	IIT Kharagpur	4 Weeks	1
10	Building Materials and Composites	1156CE414	IIT Kharagpur	8 Weeks	2
11	Strength of Materials	1156CE427	IIT Kharagpur	12 Weeks	3
12	Fluid Mechanics	1156CE452	IIT Guwahati	12 Weeks	3
13	Design of Reinforced Concrete Structures	1156CE437	IIT Kharagpur	12 Weeks	3
14	Sustainable Transportation Systems	1156CE421	IIT Roorkee	12 Weeks	3
15	Municipal Solid Waste Management	1156CE431	IIT Guwahati	12 Weeks	3

ANNEXURE – 2

Syllabus for new courses under the category of programme Core for “VTR UGE 2021”.

Programme Core		
S.No	Course	Credits
1	Strength of Materials I	3
2	Strength of Materials II	3
3	Repair and Rehabilitation of Structures	3

	STRENGTH OF MATERIALS I	L	T	P	C
		3	0	0	3

Course Category / Type: Programme Core / Theory

A. Preamble:

- This course deals about the fundamental concepts of stress, strain and deformation of solids with applications to bars, beams and thin cylinders. Also it deals with the analysis of determinate beams, trusses and basics of dynamics.

B. Prerequisite:

- Nil

C. Link to other Courses:

- Strength of Materials II

D. Course Content:

UNIT I BASICS, EQUILIBRIUM AND STRESSES 9

Units and Dimensions – System of Forces- Laws of Mechanics – Free body Diagram- Equations of Equilibrium - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions- Types of stresses – Strain, Elasticity- Hooke’s law, Limit of proportionality, Modulus of elasticity, Stress-Strain curve, Lateral strain – Deformation of simple and compound bars – Relationship between elastic constants. Principal stresses and principal planes. Theories of failures (Concept only)

UNIT II ANALYSIS OF PLANE TRUSS, THIN CYLINDERS AND SHELLS 9

Stability and equilibrium of plane frames – Types of trusses – Analysis of forces in truss members – Method of joints, Method of sections – Thin cylinders and shells under internal pressure – Deformation of thin cylinders and shells.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

Significance of geometric properties of Sections -Determination of Areas and Volumes – First moment of area and the Centroid of sections –Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Significance of mass moment of inertia (concept only).

UNIT IV TRANSVERSE LOADING ON BEAMS 9

Bending moment, shear force diagrams for simply supported, Cantilever and over hanging beams – Under Concentrated, uniformly distributed, varying distributed load, combination of above loading – Moments and Couples- Relationship between bending moment and shear force — Theory of

simple bending – Analysis of stresses – Load carrying capacity of beams – Proportioning of sections.

UNIT V BASICS OF DYNAMICS AND FRICTION 9

Displacement, Velocity and Acceleration, their relationship –Newton’s laws of motion – Work-Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies. Frictional force – Laws of Coloumb friction – Simple contact friction – Sliding Friction - Inclined planes - Angle of Repose - Belt friction – Ladder friction - Roller friction

TOTAL: 45 PERIODS

E. Learning Resources:

a) Text Books:

1. Bansal R.K., “Strength of Materials”, Laxmi Publications, 6th Edition, New Delhi, 2017.
2. Rajput.R.K. “Strength of Materials (Mechanics of Solids)”, S.Chand and Co, New Delhi, 2015
3. Beer, F.P and Johnson Jr. E.R., “Vector Mechanics for Engineers”, Statics and Dynamics, McGraw–Hill International Edition, 2019.
4. Natarajan K.V., Engineering Mechanics, Dhanalakshmi Publishers, 2011.

b) References:

1. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition, New Delhi 2015..
2. Timoshenko, S.P. and Gere, J.M. Mechanics of Materials, Tata McGraw Hill, 1992
3. William A.Nash, “Theory and Problems of Strength of Materials”, Tata McGraw-Hill publishing Co., New Delhi, 2007.
4. Srinath L.S, “Advanced Mechanics of Solids”, Tata McGraw-Hi publishing Co., New Delhi, 2007.
5. Subramanian R., “Strength of Materials”, Oxford University Press, 3rd Edition New Delhi, 2016
6. Hibbeler R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2015.
7. Kottiswaran N., Engineering Mechanics, Sri Balaji Publications Pvt. Ltd., 2015.

c) Online Resources:

1. <https://nptel.ac.in/courses/105106116/>
2. <http://nptel.ac.in/courses/112107147/>
3. <http://nptel.ac.in/courses/105106116/38>
4. <https://nptel.ac.in/courses/112/106/112106286/>
5. <https://nptel.ac.in/courses/122/104/122104015/>

	STRENGTH OF MATERIALS II	L	T	P	C
		2	0	2	3

Course Category /Type: Programme Core / Integrated Course

A. Preamble:

- This course deals about the fundamental concepts of energy principles, column strength, and deflection in beams and torsion with theory and practical knowledge.

B. Prerequisite:

- Strength of Materials I

C. Course Content:

UNIT I ENERGY PRINCIPLES 6

Strain energy method for determinate beams— Castigliano’s theorems – Principle of virtual work – Application of energy theorems for computing deflections in beams and trusses – Maxwell’s reciprocal theorems - Different failure theories for ductile and brittle materials.

UNIT II INDETERMINATE BEAMS 6

Types of beams for various loading conditions maximum at centre and maximum at end – Theorem of three moments – Analysis of continuous beams – Shear force and bending moment diagrams for continuous beams.

UNIT III COLUMNS AND THICK CYLINDERS 6

Eccentrically loaded short columns – Middle third rule – Core section – Columns of unsymmetrical sections (angle and channel sections) – Euler’s theory of long columns – Critical loads for prismatic columns with different end conditions; Rankine-Gordon’s formula for eccentrically loaded columns – Thick cylinders – Compound cylinders.

UNIT IV DEFLECTION OF BEAMS AND SHEAR STRESSES 9

Deflection of beams – Double integration method – Macaulay’s method – Conjugate Beam method – Variation of shear stress – Shear stress distribution in Rectangular, I sections, Solid circular sections, Hollow circular sections, Angle and channel sections

UNIT V TORSION AND SPRINGS 9

Stresses and deformation in circular (solid and hollow shafts) – Shafts fixed at both ends – Leaf springs – Stresses in helical springs – Deflection of springs.

LIST OF EXPERIMENTS

1. Tension Test on steel bars
2. Double shear test on mild steel
3. Torsion test on mild steel
4. Brinell and Rockwell Hardness tests
5. Charpy and Izod Impact tests on mild steel
6. Test on springs (Both closed coil and open coiled helical springs)
7. Deflection Tests on steel beams

TOTAL: 30+30 = 60 PERIODS

D. Learning Resources:

a) Text Books:

1. Rajput.R.K. "Strength of Materials (Mechanics of Solids)", S.Chand and Co, New Delhi, 2015.
2. Bansal R.K. "Strength of materials", Laxmi Publications, New Delhi, 2018.

b) Reference Book:

1. Subramanian R. "Strength of materials", Oxford University Press, New Delhi, 2016.
2. Ramamrutham, S., "Strength of Materials", DhanpatRai& Sons, 2011.
3. Bhavikatti. S., "Solid Mechanics", Vikas publishing house Pvt. Ltd, New Delhi, 2010.
4. William A. Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw-Hill publishing co., New Delhi, 2014.
5. Srinath L.S," Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2017.

c) Online resources:

1. <https://nptel.ac.in/courses/105/105/105105108/>

10212CE105	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Category / Type: Programme Elective / Theory

A. Preamble:

- The strategies of repair and maintenance.
- The importance of assessment of serviceability and durability of concrete. & Understanding the suitable repair material.
- The exposure on the repair techniques & The strengthening techniques for existing structures.

B. Pre-Requisites:

- NIL

C. Link to other Courses:

- 10211CE105 – Design of R.C Elements.
- 10211CE108 – Construction Materials and Techniques
- 10211CE203 – Concrete Technology.

D. Course Outcomes: Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Bloom's Taxonomy level
CO1	Understand the cause of deterioration and aspects of inspection.	K2
CO2	Interpret the quality of concrete and the effect of serviceability of concrete.	K2
CO3	Select appropriate Repair materials to various types of deterioration.	K2
CO4	Infer the suitable techniques to eliminate distressing in steel members	K2
CO5	Demonstrate the appropriate techniques for Strengthening of existing structures.	K2

E. Correlation of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	POS1	POS2
CO1	H				H	L	L					M		M
CO2	M	M			M	M	L					M		M
CO3	H	M			H	L	M					M		M
CO4	H	M			M	M	L					M		H
CO5	M	M			H	M	M					M		H

F. Course Content:

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance - Repair and Rehabilitation - Facets of maintenance, importance of maintenance, Various aspects of inspection - Assessment procedure for evaluating a damaged structure - Causes of deterioration. Diagnosis of construction failures- use of non-destructive testing techniques for evaluation for repair.

UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE 9

Quality assurance for concrete - Concrete properties - Strength, permeability, thermal properties and cracking - Effects due to climate, temperature, chemicals, Corrosion - Corrosion damage of reinforced concrete, corrosion resistant steels, coatings, rust eliminators. - Design and construction errors - Effects of cover thickness and cracking.

UNIT III MATERIALS FOR REPAIR IN STRUCTURAL ELEMENTS 9

Special concretes and mortar - Concrete chemicals – Special elements for accelerated strength gain - Expansive cement – Polymer concrete - Sulphur infiltrated concrete - Ferro cement - Fiber reinforced concrete., High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete. Methods of repair in masonry and timber structures.

UNIT IV TECHNIQUES FOR REPAIR AND DEMOLITION 9

Polymers coating for rebars during repair - Foamed concrete, mortar and dry pack - Guniting and Shotcrete - Epoxy injection - Mortar repair for cracks - Shoring - Methods of corrosion protection - Corrosion inhibitors - Coatings and cathodic protection - Engineered demolition techniques for dilapidated structures - Case studies.

UNIT V STRENGTHENING TECHNIQUES 9

Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure, - coatings for set concrete and steel reinforcement, - Strengthening of Superstructures: Jacketing, adding steel plates, reinforcement addition and post stressing - Strengthening of Substructures: Underpinning methods.

TOTAL: 45 PERIODS

G. Learning Resources:

a) Text Books

1. Guha, P.K, “Maintenance and Repairs of Buildings”, New Central Book Agency (P) Ltd, Calcutta, 2011.
2. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991
3. Dodge woodson, "Concrete structures - protection, Repair and Rehabilitation", Butterworth-Heinmann, imprint of Elsevier, 2009.
4. Vidivelli.B, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.

b) Reference Books

1. Macdonald, S, “Concrete - Building Pathology”, Blackwell Science Limited, Oxford, 2008.
2. Shetty, M.S, “Concrete Technology – Theory and Practice”, S. Chand and Company Ltd, New Delhi, 2012.
3. Chudley, R, “The Maintenance and Adaptation of Buildings”, Longman Group Ltd, New York, 2002.
4. Ghosh, S.K, “Repair and Rehabilitation of Steel Bridges”, Oxford and IBH Publishing Co., New Delhi, 1988.
5. A.R. Santa kumar, “Concrete Technology”, Oxford University Press, New Delhi, 2006.
6. P.K. Mehta and P.J.M. Monteiro, “Concrete - Microstructure, Properties and Materials”, McGraw-Hill, New York, 2014.
7. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

c) Online Resources

1. <https://nptel.ac.in/courses/105/106/105106202/>
2. https://onlinecourses.nptel.ac.in/noc21_ce13/preview

ANNEXURE – 3

Syllabus for new courses under the category of programme Elective for “VTR UGE 2021”.

Programme Core		
S.No	Course	Credits
1	Finite Element Method and Modelling	3
2	Advanced Strength of Materials	3
3	Environmental Management System	3
4	Rock Engineering	3
4	Failure Assessment and Rehabilitation of Structures	3
5	Remote Sensing and GIS in Transportation Development	3

	FINITE ELEMENT METHOD AND MODELLING	L	T	P	C
		3	0	0	3

Course Category: Programme Elective / Theory

A. Preamble:

- To study the basics of the Finite Element Technique, a numerical tool for the solution of different classes of problems.

B. Prerequisite:

- Nil

C. Link to other Courses:

- 10211CE110 - Structural Analysis – II

D. Course Content:

UNIT I - INTRODUCTION 9

Boundary value problems - Concept of piecewise approximation - Variational Methods - Rayleigh Ritz method - Methods of weighted residual - Collocation, sub domain, Galerkin, least square methods - Finite Difference Method - Concept of Finite element method - Displacement model, stress model and hybrid models

UNIT II - BAR AND TRIANGULAR ELEMENT PROPERTIES 9

Displacement field - compatibility and convergence criteria - Bar elements - 2D and 3D truss and beam elements - Introduction to analysis of plane strain / plane stress conditions - CST, LST and QST elements.

UNIT III - RECTANGULAR ELEMENT PROPERTIES 9

Lagrangian, serendipity and Hermitian family elements - Rectangular and quadrilateral element - degenerated elements - sub-Iso-super parametric elements - numerical integration techniques

UNIT IV – THREE DIMENSIONAL ELEMENT PROPERTIES 9

3D brick elements - eight and twenty noded elements - plate bending elements - thin plates - Mindlin's plate theory - thick plate elements.

UNIT V - MESH GENERATION AND SOLUTION PROBLEMS 9

Convergence: Requirements for convergence – p and h Methods of Mesh Refinement – ill conditioned Elements – Discretisation Errors – Auto and Adaptive Mesh Generation Techniques Error Evaluation.

TOTAL : 45 PERIODS

E. Learning Resources:

a) Text Books:

1. Krishnamoorthy C.S, "Finite Elements Analysis - Theory and Programming", Tata McGraw Hill publishing company limited, New Delhi,2008.
2. Zienkiewicz. O. C, Taylor. R. L, Zhu. J.Z, "The Finite Element Method: Its Basis and Fundamentals: Its Basis and Fundamentals", Butterworth-Heinemann, Sixth Edition, 2005.

b) References:

1. Krishnamoorthy. C. S, Rajeev. S, ArunachalamRajaraman., " Computer Aided Design: Software And Analytical Tools", U.K,2005.
2. Rajesekaran .S, "Finite Element Methods in Engineering Design", Wheeler Publishers, Allahabad,1999.
3. Chandrapatla. R.T, and Belagundu, A.D., "Introduction to Finite Elements in Engineering", Second Edition, Prentice Hall of India,1997
4. Bathe. K.J, "Finite Element Procedures in Engineering Analysis", PHI, New Delhi,1990.
5. Robert Davis Cook, David. S, Malkus, Michael. E, Plesha., "Concepts and Applicationsof Finite Element Analysis", John Wiley, , New York, Third Edition1989.
6. Zienkiewicz .O.C, and Taylor. R.L, "The Finite Element Method", Vol.1, Basic Formulation and linear problems, McGraw Hill Limited, U.K.1989.
7. Hans. R, Schwarz, "Finite Element Methods", Academic Press,1988.
8. Bruce Irons and Shrire .N, "Finite Element Primer", Ellis Howood Limited,1983.
9. Ernest Hinton. D. R. J, Owen, "Finite Element Programming", ACADEMIC Press INC, London, Fifth Edition,1979.
10. Gallagher. R.H, "Finite Element Analysis - Fundamentals", Prentice Hall Inc.1975.

	ADVANCED STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

Course Category / Type: Programme Elective / Theory

A. Preamble:

- This course deals with vector mechanics, the state of stress in 3D and special topics include unsymmetrical bending, shear centre advanced material properties. It also deals with the fundamentals of vibration.

B. Prerequisite:

- Course code – Strength of Materials II

C. Link to Other Courses:

- 10211CE105 - Design of Reinforced Concrete Elements
- 10211CE107 - Design of Steel Structures

D. Course Content:

UNIT I VECTOR MECHANICS 9

Vectors — Vector operations: Additions, Subtraction, Dot product, Cross product – Forces in Vector form–Rectangular components of forces-Position vector-Force vector in terms of coordinates-Resultant force of coplanar concurrent forces-Direction cosines- Resultant of force system in space-Moment of a force- Couple in Vector form- Resultant of non concurrent-non parallel forces.

UNIT II STATE OF STRESS IN THREE DIMENSIONS 9

Spherical and deviatoric components of stress tensor - Determination of principal stresses and principal planes – Volumetric strain – Dilatation and Distortion- Theories of failure – Principal Stress dilatation –Principal Strain –Shear stress – Strain energy and distortion energy theories — Residual stresses

UNIT III UNSYMMETRICAL BENDING 9

Properties of unsymmetrical sections- Circle of inertia - Dyadic circle - Momental ellipse- Stresses and deflection due to unsymmetrical bending - Concept and relevance of Z polygon.Curved beams – Winkler-Bach formula – Stress concentration.

UNIT IV SHEAR CENTER

9

Concept and significance - Shear flow for thin walled open sections-Location of shear centre for singly symmetric sections. Stresses in curved flexural members-Winkler Bach Formula - Crane hooks - rings and links

UNIT V MATERIAL PROPERTIES AND FUNDAMENTALS OF VIBRATION

9

Elastic and Plastic Deformation - Brittle and Ductile Failures of Materials - Mechanical Tests like Surface Hardness, Fatigue, Creep etc. Free vibration of single degree of freedom systems - Undamped and damped free vibration with different types of damping.- Resonance-Harmonic response of single degree of freedom systems with and without damping.

TOTAL: 45 PERIODS

E. Learning Resources:

d) Text Books:

1. Beer, F.P and Johnson Jr. E.R., “Vector Mechanics for Engineers”, Statics and Dynamics, McGraw–Hill International Edition, 2019.
2. Bansal R.K., “Strength of Materials”, Laxmi Publications, 6th Edition, New Delhi, 2017.
3. Rajput.R.K. “Strength of Materials (Mechanics of Solids)”, S.Chand and Co, New Delhi, 2015
4. Kazimi, S.M.A., Solid Mechanics, Tata McGraw Hill, 1976.
5. Punmia, B.C., Strength of Materials Part II, Standard Publishers and Distributors, 1991.
6. Shames I.H., Engineering Mechanics, Prentice Hall of India, 1996

e) References:

8. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition, New Delhi 2015..
9. Timoshenko, S.P. and Gere, J.M. Mechanics of Materials, Tata McGraw Hill, 1992
10. William A.Nash, “Theory and Problems of Strength of Materials”, Tata McGraw-Hill publishing Co., New Delhi, 2007.
11. Srinath L.S, “Advanced Mechanics of Solids”, Tata McGraw-Hi publishing Co., New Delhi, 2007.
12. Subramanian R., “Strength of Materials”, Oxford University Press, 3rd Edition New Delhi, 2016
13. Hibbeler R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2015.
14. Kottiswaran N., Engineering Mechanics, Sri Balaji Publications Pvt. Ltd., 2015.

f) Online Resources:

1. <https://nptel.ac.in/courses/105106116/>
2. <http://nptel.ac.in/courses/112107147/>
3. <http://nptel.ac.in/courses/105106116/38>
4. <https://nptel.ac.in/courses/112/106/112106286/>
5. <https://nptel.ac.in/courses/122/104/122104015/>

	ENVIRONMENTAL MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

Course Category / Type: Programme Elective

A. Preamble:

- To provide a basic understanding regarding the anatomy of Environmental management system that enables an organization to reduce its environmental impacts and increase its operating efficiency.

B. Prerequisite:

- NIL

C. Link to other Courses:

- NIL

D. Course Outcomes: Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Bloom's Taxonomy level
CO1	Understand the context of EMS through definitions, concepts guidelines	K2
CO2	Set out the requirements for an environmental management system by understanding the stages involved in ISO 14001:2015.	K2
CO3	Understand the Assessment procedures towards continual improvement through auditing guidelines.	K2
CO4	Understand the framework of LCA by performing robust assessments of the environmental characteristics of the system.	K2
CO5	Tradeoffs in relationship between products and Environmental impacts	K2

E. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						M	M		H	H				
CO2				L		H	H							
CO3							H		H	M				
CO4			H			M	H							
CO5						M	H							

F. Course Content:

UNIT I	INTRODUCTION	9
<p>Context of environmental management - Overview of the state of global environment - Sustainable development - Introduction to the evaluation tools - Environmental management system (EMS) - Organizational barriers - Management responsibility - Elements and extent of application - EMS structure.</p>		
UNIT II	GLOBAL PROCEDURES	9
<p>ISO 14000 – Introduction - ISO 14000 in US, Europe & Developing world - ISO 14001:2015 – Terms and Definitions – Context of the Organization – Organization and its context – Needs and expectations of interested parties – Scope of the EMS – Leadership & commitment – Environmental Policy – Organizational roles - responsibilities and authorities – Planning – Support – Operation.</p>		
UNIT III	AUDITING GUIDELINES	9
<p>Scope and objectives - Standards for auditing – Registration - Implementing the audit - Monitoring measurement analysis and evaluation of compliance – Internal audit programme – Management review – Nonconformity and corrective action – Continual improvement – Case study.</p>		
UNIT IV	IMPACT AND LIFE CYCLE ASSESSMENT	9
<p>Introduction to environmental impact assessment – EIA Procedures – Public involvement in EIA – Introduction to life cycle assessment - Components of LCA – Measuring Environmental impact - Life cycle stages of the product - Issues at each life cycle stages - Strategic framework – Case Study.</p>		
UNIT V	GREEN ASPECTS IN PRODUCT DEVELOPMENT	9
<p>Introduction to ISO/TR 14062:2002 – Product stewardship – Principles of Clean Production – Packaging – Sustainable procurement - Social responsibility and functions of corporations – Eco labelling - Ecological and carbon footprints (ISO 14064 – 65) – A case study.</p>		
TOTAL: 45 PERIODS		

G. Learning Resources:

- 1. Text Books:**
1. Christopher S. and Mark Y. (2007) Environmental Management Systems, (third edition), Earthscan Publications, First South Asian Edition.
2. David L.G. and Stanley B.D. (2001) ISO 14000 Environmental Management, Prentice Hall
3. Earthscan J.B. (edited) (2005) Environmental Management in Organizations, the IEMA Handbook (Sections 1.1, 1.2, 1.3, 3.2, 3.4, 4.3, 4.4, 5.3).
4. Harrison R.M. (edited) (2001) Pollution: Sources, Effects and Control, (selected chapters), Royal Society of Chemistry.
5. LaGrega M.D., Buckingham P.L. and Evans J.C. (1994) Hazardous Waste Management, McGraw-Hill International Edition, New York.
6. Madu C.N. (2007) Environmental Planning and Management, Imperial College Press,

(Chapters 2, 3, 4, 6, 7, 8, 10).

7. Welford R. (edited) (1996) Corporate Environmental Management: Systems & Strategies, Vol. 1&2, (Volume 1, Part 1; Part 2, chapters 3, 7, 8; Part 3, chapter 14).
8. International Standard ISO 14001: Environmental management systems – Requirements with guidance for use.
9. ISO 14064-1:2018 - Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals.
10. ISO 14064-2:2019 - Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements.
11. ISO 14064-3:2019 - Greenhouse gases — Part 3: Specification with guidance for the verification and validation of greenhouse gas statements.

2. References:

1. Cases in Environmental Management and Business Strategy Richard Welford.
2. Environmental Management Strategies: The 21st Century Perspective, Gabriele Crognale (Prentice Hall Ptr Environmental Management Series, Vol 5).
3. International Institute for Sustainable Development. 1992, Business Strategy for Sustainable Development: Leadership and Accountability for the '90s. IISD, Winnipeg, Canada, p. 116.
4. Kenneth M.M. (1999) Basic Concepts in Environmental Management, Boca Raton, FL, Lewis.
5. United Nations Industrial Development Organization Report on an Expert Group Meeting on the Potential Effects of ISO 9000 and ISO 14000 Series and Environmental Labeling on the Trade of Developing Countries (1995) Vienna, 23-25.
6. US EPA (1997) The Environmental Audit Program Design Guidelines for Federal Agencies, EPA 300-B-96-011, Washington, D.C.
7. Virginia H.D. and Mary R.E. (eds.) (1999) Tools to Aid Environmental Decision Making, New York, Springer.

3. Online Resources

1. <https://www.iso.org/standard/60857.html>
2. https://onlinecourses.nptel.ac.in/noc21_ce47/preview
3. https://www.apec.org/docs/default-source/Publications/2005/2/ECODESIGN-Best-Practice-of-International-Organization-for-Standardization-ISOTR-14062-2005/05_cti_scsc_ecodesign.pdf
4. <https://www.sis.se/api/document/preview/903359/>

	ROCK ENGINEERING	L	T	P	C
		3	0	0	3

Course Category/Type: Programme Elective / Theory

A. Preamble :

The construction industry has extended its horizon in all aspects. The maximum usage of all land area is the need of the current scenario, which includes construction in hard substrata (rocks). Thus this course is designed to expose the students to understand the properties and insitu strength of rocks.

B. Pre-Requisites:

- 10211CE202 - Soil Mechanics

C. Link to other course

- 10211CE111 - Foundation Engineering

D. Course Outcomes:

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's taxonomy)
CO1	Classify rocks and identify the various engineering properties.	K2
CO2	Understand the strength and behaviour of hard strata.	K2
CO3	Infer the stress distribution under influence of various conditions	K2
CO4	Establish the shear strength parameters and stability in slopes.	K2
CO5	Do understand the various stabilization techniques.	K2

E. Course Content:

UNIT I SUBSTRATUM ANALYSIS 9

Introduction to Geo morphology- Types of substratum layers- Types of Rocks - Index properties of hard strata minerals and classification of rock masses based on stratification, composition and morphology - Rock mass ratings and its significance in field estimations.

UNIT II CHARACTERISTIC STRENGTH OF HARD STRATUM 9

Behaviour of rock under hydrostatic compression and deviatoric loading - Modes of rock failure - planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut-off. Hoek and Brown Strength criteria for rocks with discontinuity sets.

UNIT III ONSITE STRESSES IN SUBSTRATA LAYERS 9

In situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks - case studies.

UNIT IV SLOPE STABILITY AND BEARING CAPACITY 9

Slope stability in rocks - role of discontinuities in slope failure, slope analysis and factor of safety - remedial measures for critical slopes – Bearing capacity of foundations on rocks – case studies.

UNIT V SUBSTRATA STABILIZATION 9

Instability in rocks. Reinforcement of fractured and jointed rocks. Techniques - shotcreting, bolting, anchoring; its significance and installation methods, operation and maintenance - case studies.

TOTAL: 45 PERIODS

F. LEARNING RESOURCES:

a. Text book

1. T. Ramamurthy, Editor, Engineering in Rocks for Slopes Foundations and Tunnels, PHI Learning Pvt. Ltd., 2007.

b. References

1. Goodman, R.E., Introduction to rock mechanics, John Wiley and Sons, 1989.
2. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 1997.
3. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K. 1981.

4. Hoek, E. and Brown, E. T., Underground Excavations in Rock, Institute of Mining and Metallurgy, U.K. 1981.
5. Obert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1967.
6. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.
7. Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springer-Verlag, Berlin, 1990.
8. Waltham, T., Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.

c. **Online resources**

1. <https://nptel.ac.in/courses/105106055>
2. <https://nptel.ac.in/courses/105105212>
3. <https://www.youtube.com/watch?v=-1jQ6qLDir8>

	FAILURE ASSESSMENT OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Category / Type: Programme Elective / Theory

A. Preamble:

- To understand the deterioration process of structures.
- To know about repair materials.
- To assess the condition of the structure.

B. Prerequisite:

- NIL

C. Link to other Courses:

- NIL

D. Course Outcomes: Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Bloom's Taxonomy level
CO1	Understand the procedure for assessment of fire damaged structures.	K2
CO2	Learn about the settlement of structures.	K2
CO3	Understand the mechanism of corrosion of rebar.	K2
CO4	Learn about design and construction errors.	K2
CO5	Understand the damaged structure due to earthquake.	K2

E. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L					L		M				M		
CO2	L	M			M	L	M					M		
CO3	L	L				M						M		
CO4	L					M	M	M				M		
CO5	M				M	M	M	H				M		

F: Course Content :

UNIT I FIRE DAMAGES 9

Fire damages mechanism - Surface cracking - Chemical decomposition - Microcracking and spalling - Assessment methods - Preliminary investigation - Cleaning - Visual inspection - Fire intensity - Field test - Detailed investigation - Non destructive tests - Destructive test methods - case studies - Assessment report.

UNIT II SETTLEMENT DAMAGES 9

Structural settlement - Causes for structural settlement - Soil settlement - Foundations structural settlement - Types - Immediate structural settlement - Structural settlement due to consolidation - Methods of predicting structural settlement - Methods of settlement control - Case studies - Assessment report.

UNIT III CORROSION DAMAGES 9

Causes of corrosion - Mechanism of corrosion - Types - Corrosion process - Formation of white batches - Occurrence of cracks - Formation of multiple cracks - Spalling of cover concrete - Bulging - Delamination - Prevention measure - Repairing technique - Case studies - Assessment report.

UNIT IV DESIGN AND CONSTRUCTION ERRORS 9

Design and detailing errors - Causes - Types of design error - Inadequate structural design - Poor design details - Prevention - Construction errors - Causes - Types of construction errors - Prevention methods - Repairing techniques - Assessment report.

UNIT V DAMAGE DUE TO EARTHQUAKES 9

Earthquake effects - Causes - Ground shaking - Ground failure - Tsunamis - Failure mechanism of earthquakes - Free standing masonry wall - Wall encloser without roof - Roof on two walls - Roof on wall encloser - Roofs and floors - Long building with trusses - Shear wall with opening - Prevention measure - Repairing techniques - Assessment report.

TOTAL = 45 PERIODS

F. Learning Resources:

a) Text Books:

1. Ransom, W.H., Building Failures, Taylor & Francis, 2002.
2. Perkins, P., Repair, Protection and Waterproofing of Concrete Structures, CRC Press, 2019.
3. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 2014.

b) References:

1. Ravindra, V, Jeffrey, G, Protection of Concrete, CRC Press, 2014.
2. Richardson, B.A., Remedial Treatment of Buildings, Butterworth- Heinemann, 2020.
3. Breyse, D., Non-Destructive Assessment of Concrete Structures: Reliability and Limits of Single and Combined Techniques, Springer Publishers, 2012.

c) Online Resources:

1. <https://www.youtube.com/watch?v=cX2FdjV4eOY>
2. <https://archive.nptel.ac.in/courses/105/106/105106202/>
3. <https://archive.nptel.ac.in/courses/105/105/105105213/>

	REMOTE SENSING AND GIS IN TRANSPORTATION DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Category / Type: Programme Elective / Theory

A. Preamble:

- Students undergoing this course are expected to know about the recent techniques of Remote Sensing and GIS and its application in Traffic and Transportation Engineering.
- The students would have knowledge on the basics of Remote Sensing and GIS techniques and their application in the Transport sectors.

B. Prerequisite:

- 10212CE125 - Transportation Engineering

C. Link to other Courses:

- 10212CE122 - Introduction to Remote Sensing
- 10212CE123 - Geographical Information System
- 10212CE125 - Intelligent Transport System

D. Course Outcomes: Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Bloom's Taxonomy level
CO1	Understand the basic concepts and components of remote sensing.	K2
CO2	Understand the basic concepts and components of GIS.	K2
CO3	Interpret the various data structures, analysis and techniques for GIS modeling.	K2
CO4	Summarize the basic applications of RS and GIS in transportation sector.	K2
CO5	Summarize the role of advanced applications of RS And GIS in intelling transportation system.	K2

E. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	L	M		M		M								
CO2	M	M				M								
CO3	M	M	M		L									
CO4	L	M				L								
CO5	M	M		M		M								

c) Online Resources:

1. <https://nptel.ac.in/courses/105108073>
2. <https://archive.nptel.ac.in/courses/105/103/105103193/>

ANNEXURE – 4

Value Education Elective offered under VTUR15section 7.2.6 for the Winter Semester of AY 2021-2022

1155CE102 -BEHAVIOUR FOR INNOVATION

A. Course Outcomes

With the completion of the course, students are expected to:

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Differentiate between inventing and innovating	K2
CO2	Outline the human brain functioning	K2
CO3	Translate the process of innovation journey	K2
CO4	Explain the innovation model in engineering context	K2
CO5	Relate the essence of innovating behaviour through case studies	K2

B. Correlation of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						H						H		
CO2						H						H		
CO3												H		
CO4												H		
CO5						H						H		

C. Course Content

UNIT I Inventing vs Innovating: Definition for creativity, invention, innovation, entrepreneurship and startup – Difference between invention and innovation – Examples of innovations – The Edison way.

UNIT II The way human brain works: Code communication – Pattern generation and recognition – Concept of analogy – Example of Jaipur foot.

UNIT III Formula of Innovation: Equation of creativity, innovation and the journey through – Design thinking and sustainable thinking - 10000 hrs rule – Maslow's motivation theory –

UNIT IV Innovation model for Engineering: 5 hand rule – PATTAM model for engineering innovations.

UNIT V Case studies: Redesigned Indian Post Box - Solar oven - Vein tracer - Petrol dispenser – Redesigned Palki.

TOTAL: 15 PERIODS

REFERENCES:

1. B.K. Chakravarthy and JanakiKrishnamoorthi. “Innovation by Design: Lessons from Post box design and development”, Springer, 2013.
2. Karsnitz, O’Brien and Hutchinson, “Engineering Design - An Introduction 2nd Edition” Cengage Publication, 2013.
1. Edward de Bono, “Lateral Thinking” Penguin Life Publication, 2016.

STUDENT LIST WITH SCORE				
S.No	VTU No	Name of the Student	Total Marks	Grade
1	vtu11076	CHINGAK DANTED P PHOM	86	A
2	vtu11077	VESUZO RINGA	88	A
3	vtu11350	BAIRU KEERTHAN GOUD	90	S
4	vtu11529	INOHUKA AYE	76	B
5	vtu11566	ALLU ADITYA	67	C
6	vtu11738	MAIBAM YAIKHOMBA MEETE	69	C
7	vtu11798	CH RAJJEV KUMAR SINGH	86	A
8	vtu11802	KEYIGUMLUNGLE IHEILUNG	90	S
9	vtu11814	KHITOLU A YEPTHO	79	B
10	vtu11885	KEVISEBINO NAGI	90	S
11	vtu11904	RAHUL KUMAR	86	A
12	vtu11926	SOYIMYANGERLA N SANGIR	86	A
13	vtu11932	BIKU NAOREM	87	A
14	vtu11934	LOUREMBAM ERIC	87	A
15	vtu11944	MOLOCHIT	87	A
16	vtu11954	MISHALIN DIENGGAN	89	A
17	vtu11955	PYSAN BORLANG ROBERTS LYNGDOH	89	A

18	vtu11975	AMRENDRA KUMAR	88	A
19	vtu12228	K JAGAN PREETHAM NAIDU	53	D
20	vtu12360	S.ANISH KUMAR	70	B
21	vtu12396	SHAIK ABDUL AZEEZ	24	U
22	vtu12496	THOTAKURI HARIKRISHNA	66	C
23	vtu12589	TANNIRU VENKATA KRISHNA	76	B
24	vtu12729	REVILLA ADHARSH	0	U
25	vtu13079	T.VISHNU VARDHAN REDDY	90	S
26	vtu13423	VALLU NAGA KOTESWARA RAO	86	A
27	vtu13571	VIKAS KIRAN.M	90	S
28	vtu13720	THATIGOTTA KEERTHI REDDY	86	A
29	vtu13810	JAMBHEY TASHI	89	A
30	vtu13918	SANATHI GNANA PRIYA	87	A
31	vtu13954	GADDAM BHASWIK A	69	C
32	vtu13958	PASUPULETI AKHIL SAI	61	C
33	vtu13965	NITISH KUMAR	86	A
34	vtu13972	RAHUL SINGH	65	C
35	vtu14027	CHATLA SUDHA KIRAN TEJA	91	S
36	vtu14417	LALRUATPUII RALTE	90	S
37	vtu15122	PALA MUKHESH KUMAR	91	S
38	vtu15156	PARIKSHIT PRIYADARSHI	92	S
39	vtu15174	R.SAI KIRAN REDDY	86	A
40	vtu15236	KOTA PAVAN KUMAR	90	S
41	vtu15278	CH MAHESH KUMAR	67	C
42	vtu15433	K.SATYANARAYANA	65	C
43	vtu15620	MULLAPADI HARISH CHOWDARY	0	U
44	vtu15871	M.V.NARAYANA	89	A
45	vtu15979	DOMNIC SAVIO P	60	C

46	vtu16192	DIPAK KHATRI	88	A
47	vtu16210	AAYUSH.K.K	86	A
48	vtu16213	SUNIL KUMAR YADAV	85	A
49	vtu16220	GYAN KUMAR RAY	87	A
50	vtu16222	NGIM SANGE SHERPA	89	A
51	vtu16225	ANUP OLI	87	A
52	vtu16241	ANISH SHAH	88	A
53	vtu16242	RAJU GHIMIRE	88	A
54	vtu16252	RAM SHARAN YADAV	88	A
55	vtu16257	PRAMOD CHAUDHARY	87	A
56	vtu16259	RITESH KUNWAR	89	A
57	vtu16261	MANOJ KUMAR YADAV	86	A
58	vtu16262	DILISH KUMAR YADAV	86	A
59	vtu16263	ROSHAN KUMAR YADAV	84	A
60	vtu16264	DILIP KUMAR YADAV	86	A
61	vtu16269	SUJEET DHAKAL	86	A
62	vtu16350	SUBODH KUMAR YADAV	84	A
63	vtu16363	SHAIK SHAHI AFRID	52	D
64	vtu16365	WINFIELD MARBANIANG	88	A
65	vtu18100	YEKAMBARAM NAVEEN	89	A
66	vtu18712	SHRUTHI KUMARI JHA	88	A
67	vtu18732	APEKSHYA GHIMIRE	87	A
68	vtu18734	RAHUL KUMAR ROY	87	A
69	vtu18735	DURGESH KUMAR CHOWDARY	86	A
70	vtu18738	UJWAL KUMAR ROY	91	S
71	vtu18906	POOSALA SHIVAMANI	63	C

ANNEXURE – 5

**Students awarded credits for independent learning – MOOC Courses under VTUR15 7.2.7.1
for UG Winter Semester of AY 2021-22 & under VTUR167.2.4.1 for PG Winter Semester of AY
2021-22**

Credits Awarded under MOOC for 2021-22 Winter Semester – U.G

S. No	VTU No	Name of the Student	Course Code	Title of the Course	Marks Obtained	Grade	Credits
1	11735	MALSON SHARMA	1156CE467	Landscape Architecture and Site Planning - Basic Fundamentals	64	C	2
2	11729	K.H.KATTE SINGH	1156CE409	Digital Land Surveying And Mapping	69	C	2
3	11738	MAIBAM YAIKHOMBA MEETE	1156CE409	Digital Land Surveying And Mapping	0	U	0
4	16222	NGIM SANGE SHERPA	1156CE409	Digital Land Surveying And Mapping	83	A	2
5	12584	MADASANI GNANA CHARAN TEJA	1156CE411	Concrete Technology	0	U	0
6	15350	ASODI KUSUMA HARI HARA NADHA REDDY	1156CE411	Concrete Technology	0	U	0
7	17449	BOLLU SAI VENKATA DURGA BHAVANI PRASAD	1156CE411	Concrete Technology	0	U	0
8	21605	PULIJALA BHAVANI	1156CE411	Concrete Technology	40	U	0
9	21607	RAHUL PAUL	1156CE411	Concrete Technology	0	U	0
10	21609	SHEELA RAGHAV	1156CE411	Concrete Technology	40	U	0
11	21627	VULLI SAI MANIKANTA	1156CE411	Concrete Technology	64	C	3
12	21635	BARATH R A	1156CE411	Concrete Technology	0	U	0
13	21660	YEDDU GIRISH	1156CE411	Concrete Technology	63	C	3
14	11461	ABHINAV KUMAR	1156CE413	Air Pollution and Control	75	B	2
15	10983	C.RAJESH	1156CE422	Natural Hazards	0	U	0
16	11011	SHENDGE ATUL RAVINDRA	1156CE422	Natural Hazards	86	A	2
17	11314	KERMIKI BIAM	1156CE422	Natural Hazards	64	C	2
18	11711	IMNAYANGLA JAMIR	1156CE422	Natural Hazards	0	U	0
19	11728	TTENZIN TASHIKHUM	1156CE422	Natural Hazards	75	B	2
20	11743	COI LOHE	1156CE422	Natural Hazards	86	A	2
21	11744	TEJOSEHO KHATSO	1156CE422	Natural Hazards	79	B	2
22	11773	KASANCHI CHSANGMA	1156CE422	Natural Hazards	73	B	2
23	11790	TUNGFA LAMGU	1156CE422	Natural Hazards	71	B	2
24	11934	LOUREMBAM ERIC	1156CE422	Natural Hazards	66	C	2
25	13564	J.BHUVAN SRIRAM	1156CE422	Natural Hazards	0	U	0

26	8767	NAGOLU UPENDRA REDDY	1156CE422	Natural Hazards	0	U	0
27	11730	KONSAM SURJA KANTHA	1156CE425	Safety in Construction	61	C	2
28	11734	TOTTO THOKCHOM	1156CE425	Safety in Construction	66	C	2
29	13736	NARAYANACHARI ANNAMALI	1156CE425	Safety in Construction	0	U	0
30	13954	GADDAM BHASWIKA	1156CE425	Safety in Construction	40	U	0
31	13978	K.SANJAY	1156CE425	Safety in Construction	40	U	0
32	16225	ANUP OLI	1156CE425	Safety in Construction	73	B	2
33	16242	RAJU GHIMIRE	1156CE425	Safety in Construction	73	B	2
34	11798	CH RAJJEV KUMAR SINGH	1156CE438	Introduction to Accounting and Finance for Civil Engineers	0	U	0
35	11932	BIKU NAOREM	1156CE438	Introduction to Accounting and Finance for Civil Engineers	0	U	0
36	11449	SHIVAM KUMAR SINGH	1156CE485	Introduction to Civil Engineering Profession	100	S	2
37	11963	ANDRA KOMAL SRI SAI	1156CE485	Introduction to Civil Engineering Profession	75	B	2
38	13031	GOURAV JAISWAL	1156CE485	Introduction to Civil Engineering Profession	94	S	2
39	13413	BANDHARAPU RAHUL	1156CE485	Introduction to Civil Engineering Profession	79	B	2
40	13504	KANNAPATI RAGHU VAMSI	1156CE485	Introduction to Civil Engineering Profession	0	U	0
41	13551	SHAIK ABDUL SAMAD	1156CE485	Introduction to Civil Engineering Profession	73	B	2
42	13587	MANMOHAN JHA	1156CE485	Introduction to Civil Engineering Profession	83	A	2
43	13599	ABDUL JAMIL MUSALMAN	1156CE485	Introduction to Civil Engineering Profession	96	S	2
44	13602	SAHENDRA YADAV	1156CE485	Introduction to Civil Engineering Profession	86	A	2
45	13935	AKURI NAVEEN REDDY	1156CE485	Introduction to Civil Engineering Profession	70	B	2
46	14027	CHATLA SUDHA KIRAN TEJA	1156CE485	Introduction to Civil Engineering Profession	78	B	2
47	14042	VIKAS DHANGAR	1156CE485	Introduction to Civil Engineering Profession	100	S	2
48	14417	LALRUATPUII RALTE	1156CE485	Introduction to Civil Engineering Profession	85	A	2
49	14924	K.DILEEP MADHU KUMAR	1156CE485	Introduction to Civil Engineering Profession	94	S	2
50	15122	PALA MUKHESH KUMAR	1156CE485	Introduction to Civil Engineering Profession	66	B	2
51	15169	PATAN IMRAN	1156CE485	Introduction to Civil Engineering Profession	81	A	2
52	15186	B.PRADEEP KUMAR	1156CE485	Introduction to Civil Engineering Profession	71	B	2
53	15278	CH MAHESH KUMAR	1156CE485	Introduction to Civil Engineering Profession	66	B	2

54	15424	VAMBARAVELLI SAI TEJA	1156CE485	Introduction to Civil Engineering Profession	66	B	2
55	15433	K.SATYANARAYANA	1156CE485	Introduction to Civil Engineering Profession	83	A	2
56	15722	PARISIGANI VAMSI KRISHNA	1156CE485	Introduction to Civil Engineering Profession	73	B	2
57	16246	RAVI JAISWAL	1156CE485	Introduction to Civil Engineering Profession	100	S	2
58	11711	IMNAYANGLA JAMIR	1156CE414	Building Materials and Composites	86	A	2
59	11713	SKHEMBORLANG PYNGROPE	1156CE414	Building Materials and Composites	96	S	2
60	13035	JAYANT LUNANI	1156CE414	Building Materials and Composites	71	B	2
61	11738	MAIBAM YAIKHOMBA MEETE	1156CE414	Building Materials and Composites	76	B	2
62	11350	B. KEERTHAN GOUD	1156CE414	Building Materials and Composites	76	B	2
63	11771	CHELLO KANAM	1156CE414	Building Materials and Composites	75	B	2
64	10983	C. RAJESH	1156CE414	Building Materials and Composites	69	B	2

Credits Awarded under MOOC for 2021-22 Summer Semester – P.G

S.No	VTP No	Name of the Student	Course Code	Title of the Course	Marks Obtained	Credits
1	2657	ERIC BUTEY MITA BAZIK	2163CE427	Geotechnical Engineering II Foundation Engineering	85	2
2	2434	R NANDHINI	2163CE429	Ground Improvement Techniques	60	2
3	2435	A PARAMESWARI	2163CE429	Ground Improvement Techniques	60	2
4	2197	UMESH SELVAKUMAR	2163CE433	Principles of Construction Management	51	2
5	2452	BOYA RAMUDU	2163CE431	Sustainable Engineering Concepts and Life Cycle Analysis	67	2
6	2451	MULA RAMA RAO	2163CE431	Sustainable Engineering Concepts and Life Cycle Analysis	61	2
7	2437	PALEPU VIJAYA KUMAR	2163CE432	Municipal Solid Waste Management	54	2
8	2801	U PRABHAKARAN	2163CE401	Integrated Waste Management For A Smart City	76	2
9	2860	K OMPRAKASH	2163CE410	Infrastructure Planning And Managements	54	2

ANNEXURE – 6

**Students awarded credits for independent learning - Seminar under VTUR15
Sec.7.2.7.2 in Winter Semester of AY 2021 – 22**

1156CE501 - SEMINAR I (2021-2022) WINTER SEMESTER			
S. No	Name	Vtu No	Course total (Real)
1	KAVIRI RAJABABU	VTU18903	92
2	CHINGAK DANTED P PHOM	VTU11076	93
3	VESUZO RINGA	VTU11077	94
4	POOSALA SHIVAMANI	VTU18906	95
5	HENDOK	VTU11078	93

1156CE502 - SEMINAR II (2021-2022) WINTER SEMESTER			
S. No	Name	Vtu No	Course total (Real)
1	PYNENI VENU .	VTU6226	54
2	NAGOLU UPENDRA REDDY	VTU8767	54
3	SAJID ANSARI	VTU10489	0
4	S.ABHIHITH	VTU14690	60
5	K.MADHUSUDHANA RAO	VTU14844	71
6	EDLA JITHENDER REDDY	VTU12279	0
7	MISHALIN DIENGGAN	VTU11954	82
8	K BALAJI	VTU12592	92
9	REVILLA ADHARSH	VTU12729	76
10	R LINGA REDDY	VTU15218	82
11	PARISIGANI VAMSI KRISHNA	VTU15722	81
12	AKASH.M	VTU13278	91
13	BANDHARAPU RAHUL	VTU13413	74
14	KANNAPATI RAGHU VAMSI	VTU13504	80
15	J.BHUVAN SRIRAM	VTU13564	0
16	PASUPULETI AKHIL SAI	VTU13958	0
17	BAGRACE TYMPUIN	VTU13959	90
18	FLINDER RAPSANG	VTU15173	90
19	NATHI RAJU	VTU15242	63
20	MULLAPADI HARISH CHOWDARY	VTU15620	0
21	ANISH SHAH	VTU16241	93

22	INOHUKA AYE	VTU11529	78
23	CH RAJJEV KUMAR SINGH	VTU11798	98
24	KHITOLU A YEPTHO	VTU11814	78
25	ROHIT KUMAR	VTU11970	90
26	AMRENDRA KUMAR	VTU11975	89
27	SHAIK ABDUL SAMAD	VTU13551	90
28	NARAYANACHARI ANNAMALI	VTU13736	76
29	BHUMIREDDY SREENADH REDDY	VTU15865	91
30	M.THARUN SAI SIVA KRISHNA REDDY	VTU15873	80
31	SURENDRA KUMAR SAH	VTU16143	85
32	KEYIGUMLUNGLE IHEILUNG	VTU11802	78
33	KEVISEBINO NAGI	VTU11885	83
34	MEKA SUSHMA	VTU13916	72
35	SANATHI GNANA PRIYA	VTU13918	67
36	PALA MUKHESH KUMAR	VTU15122	82
37	PARIKSHIT PRIYADARSHI	VTU15156	89
38	PATAN IMRAN	VTU15169	77
39	B.PRADEEP KUMAR	VTU15186	81
40	CH MAHESH KUMAR	VTU15278	75
41	RAJU GHIMIRE	VTU16242	87
42	SOYIMYANGERLA N SANGIR	VTU11926	78
43	IMLISUNEP JAMIR	VTU11927	0
44	BIKU NAOREM	VTU11932	92
45	SANTA SINAM	VTU11933	0
46	LOUREMBAM ERIC	VTU11934	98
47	MOLOCHIT	VTU11944	78
48	SHAHID AFRID SHAIK	VTU12029	0
49	JAMBAY TASHI	VTU13810	83
50	AKURI NAVEEN REDDY	VTU13935	81
51	CHATLA SUDHA KIRAN TEJA	VTU14027	82
52	N.TEJASWINI REDDY	VTU14040	87
53	K.SATYANARAYANA	VTU15433	74
54	AAYUSH.K.K	VTU16210	91
55	KOPPANATHULA RAJA MOHAN	VTU16499	67
56	PYSAN BORLANG ROBERTS LYNGDOH	VTU11955	91
57	ANDRA KOMAL SRI SAI	VTU11963	81
58	ANSHURAJ	VTU13942	85

59	GADDAM BHASWIK A	VTU13954	55
60	NITISH KUMAR	VTU13965	77
61	M.SELVA KUMAR	VTU13967	85
62	VIKAS DHANGAR	VTU14042	90
63	PRAVEEN KUMAR	VTU14059	80
64	VAMBARAVELLI SAI TEJA	VTU15424	76
65	DIPAK KHATRI	VTU16192	80
66	SUBODH KUMAR YADAV	VTU16350	85
67	SENTISHILU PONGEN	VTU11972	80
68	RAVI JAISWAL	VTU16246	90
69	CHILLA AVINASH	VTU16356	77
70	RAHUL SINGH	VTU13972	93
71	SUNIL KUMAR YADAV	VTU16213	89
72	NGIM SANGE SHERPA	VTU16222	78
73	GYAN KUMAR RAY	VTU16220	95
74	SUJEET DHAKAL	VTU16269	91
75	ARBIND KUMAR YADAV	VTU16253	83
76	WINFIELD MARBANIANG	VTU16365	85
77	ANUP OLI	VTU16225	93
78	NIRMAL SUBEDI	VTU16273	85
79	K.SANJAY	VTU13978	76
80	RITESH KUNWAR	VTU16259	84
81	MANOJ KUMAR YADAV	VTU16261	95

ANNEXURE – 7

**Students awarded credits for independent learning – Major Project under VTUR15
Sec.7.2.7.2 Winter Semester of AY 2021–22**

Sl. No.	Vtu. No	Name	Project Type	Batch No.	Internal Guide	Project Title
1	12878	Samuel Johnson E	In- house (BATCH-I)	1	Dr.S.Samson	Planning and Designing of G+2 Residential Building
2	14348	Kasu Venkatesh				
3	12134	Pamarthi Vishnu Teja				
4	11693	Longpai H Konyak		2	Mr. M. Bharath	Analysis of Shape Modified Aggregate in Concrete Properties
5	11743	CoiLohe				
6	11744	Tejoseho Khatso		3	Mr. R. Robert Singh	Experimental Study on Baryte Mines from Mangampeta
7	12451	T. Indrasena Reddy				
8	14536	Mallela Vinay Kumar Reddy				
9	14690	S.Abhihith		4	Mr.T.Udayakumar	Development and Microstructure Properties of Geopolymer Aggregate Concrete
10	11144	M.Durga Pavan Kumar				
11	12340	K.Surya Chandra				
12	12744	P.Mohan Reddy		5	Dr.M.Vinod Kumar	Life Cycle Assessment of Perishable Wastes from Vegetable Market
13	10943	S.Vamshikrishna Reddy				
14	13370	Araveti Maheswar Reddy				
15	14604	K.Venkata Subbaiah		6	Dr.J.Logeshwari	Soil Stabilisation By Using MICP Technique
16	11790	Tungfa Lamgu				
17	13599	Abdul Jamil Musalman				
18	11278	P.Venkata Karthik Kumar		7	Dr. G. Kumar	Hydrogeochemical Analysis For Identification of Ground Water Quality Around Trippur District Chennai Tamil Nadu
19	13035	Jayant Lunani				
20	10416	Arroju Sai Vignan				
21	13602	Sahendra Yadav		8	Mr. M Sridhar	Study on Structural Behaviour of Precast Sandwich Panels
22	11698	S M Naghulan				
23	11697	U Vignesh				
24	14311	J Premsagar		9	Dr. S. Samson	A Comparative Study of Mechanical Properties of Concrete Produced By GGBS With Silica Fume
25	6226	Pyneni Venu .				
26	8767	Nagolu Upendra Reddy				
27	9693	Podishetti Vishnu Goud		10	Mr. T. Udhaya Kumar	Studies on Durability Properties of Geopolymer Aggregate
28	11730	Konsam Surjakanta				

29	11295	Gannavarapu Venkata Himanshu	Industry	11	Dr.M. Vinod Kumar	Study on Self-Healing Efficiency of Cracks in Self-Curing Concrete With Different Types of Fibers.
30	11727	Lobsang Pema		12	Ms.V. Yamini	Planning, Analysis, Design and Estimation of A High Rise Building
31	14383	Nithu Sarkar		13	Mr. T. Nelson Ponnudurai	Major Bridge Construction Across Kosi River
32	11745	Dzuthohu Keyho		14	Ms. D G S Nivedha	Modified Rapid Sand Filter Using Powdered Brick and Wood Capping: Under JalJeevan Mission
33	11458	Abhishek Nikhil		15	Ms. S. Sivaranjani	Analytical Study on Soft Storey and Masonry Wall To Construct Earthquake Resistant Structure
34	11428	Altamash Khan		16	Mr. M Sridar	Geotechnical Investigation and Foundation Design of Major Bridge At CH.218+428
35	11449	Shivam Kumar Singh		17	Mr. K. Cheran	Analysis and Design of Retrofitted G+4 Residential Building
36	13031	Gourav Jaiswal		18	Mr. R. Robert Singh	Planning, Analysis and Design of A Four Storeyed Residential Building Using STAAD Pro
37	13587	Manmohan Jha		19	Dr.K. Tamilarasan	Analysis and Design of Multi Storeyed Building in A Seismic Zone By Using Etabs
38	12470	Apurv Kumar		20	Ms. A. Mahalakshmi	Construction of Rigid Pavement in Rural Area
39	11011	Shendge Atul Ravindra		21	Dr.S.P.Saravanan	Gis Application on Modular Integrated Construction.
40	11711	Imnayangla Jamir		22	Mr. S. Baskar	Detailed Project Report of Minor Irrigation Project
41	12435	S.Bobby Suharsh		23	Dr.S.Selvakumar	Comparison of Building Loads Using Conventional Bricks Vs AAC Blocks
42	14271	S.Sai Charan		24	Dr.J.Logeshwari	Causes, Prevention and Repair of Cracks in Buildings
43	12900	K.Gowri Sudha		25	Dr.S.Kandasamy	Assessment of (G+1) Residential Building
44	12988	A.Chandra Mouli		1	Dr.K.R.Aswin Sridhar	Utilization of Polymeric based adsorbent for the removal of mercury from water
45	12207	N D N V Manikanta Manohar				
46	12171	Syed Jilani				
47	12961	M N V P Raja Rao Gupta				
48	12375	Gude Rohith				
49	14185	Cheekatla Shiva Ganesh				
50	11793	M.Imnasunep Aier				
51	14263	v.v.v. Sai Padma				
52	12976	R .Sai Kiran				
53	13245	E.Prasad				
54	11461	Abhinav Kumar				
55	11314	Kermiki Biam				
56	11713	Skhemborlang Pyngrope				
57	12972	K. Naga Sai Santoshi Lakshmi				
58	14844	K Madhusudhana Rao				
59	11773	Kasanchichsangma				
60	14417	Lalruatpuiiralte				
61	11728	Tenzin tashikhum				

62	11350	Bairukeerthangoud	In- house (BATCH- II)	2	Mr.S.Bhaskar	Conversion of conventional building to green building
63	13347	Gangaramchennakeshava				
64	14924	Kollidileepmadhukumar		3	Dr.K.R.AswinSidh aarth	Application of Bio- nano composites as an adsorbent for mercury removal from waste water.
65	11734	Tottothokchom				
66	11731	Monexsukham		4	Dr.M.Vinod Kumar	Strength, durability & microstructural characteristics of fibre reinforced geopolymer concrete with treated foundary sand
67	11721	Kanjamborish				
68	10983	C.Rajesh		5	Mr.K.Cheran	Study on effects of double headed fabric fibres on concrete properties
69	11737	Akhongbampulltowin				
70	11738	Maibamyaikhombameetei				
71	11735	Guruharibammalsonsharma				
72	11771	Chellokanam				
73	11729	Khagokpamkattesingh	6			

ANNEXURE – 8

**Students awarded credits for independent learning - In-plant Training under
VTUR15Sec.7.2.8.2 and 8.3.8 Winter semester of AY 2021-2022**

Sl. No.	VTU No.	Name of the student	Company name	Starting Date	End Date
1	18712	SHRUTI KUMARI JHA	Cybercity PVT LTD, Mangadu, Chennai	18/07/2022	23/07/2022
2	21623	LITI .H. YEPTHO	Cybercity PVT LTD, Mangadu, Chennai	18/07/2022	23/07/2022
3	18738	UJJAWAL KUMAR ROY	Cybercity PVT LTD, Mangadu, Chennai	18/07/2022	23/07/2022
4	18734	RAHUL KUMAR ROY	Athira Geo Spatial Services Private Limited	18/07/2022	23/07/2022
5	18653	SAILESH KUMAR YADAV	Athira Geo Spatial Services Private Limited	18/07/2022	23/07/2022
6	21609	S RAGHAV	CPWD ANNA NAGAR	18/07/2022	23/07/2022
7	21605	P BHAVANI	CPWD ANNA NAGAR	18/07/2022	23/07/2022
8	21627	V SAI MANIKANTA	CPWD ANNA NAGAR	18/07/2022	23/07/2022
9	21622	KHEKUGHA K AYE	ENTEELLUS IOT LABS PVT. LTD., Hyderabad	18/07/2022	22/07/2022
10	21660	Y. GIRISH	ENTEELLUS IOT LABS PVT. LTD., Hyderabad	18/07/2022	22/07/2022
11	21638	MAMIDI RAJA VAMSI	ENTEELLUS IOT LABS PVT. LTD., Hyderabad	18/07/2022	22/07/2022
12	21647	V.PREMSAI	ENTEELLUS IOT LABS PVT. LTD., Hyderabad	18/07/2022	22/07/2022

ANNEXURE – 9

**Courses offered by Industry/Higher Learning Institute Interaction Specialized Courses
under VTUR15 Section 7.2.8.3 Winter Semester of AY 2021-2022**

STUDENT FINAL TEST SCORE

Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

School of Mechanical and Construction

Department of Civil Engineering

Industry/Higher Learning Institute Interaction – Course

Course Title	Advanced/Modern Surveying Techniques
Course Code	1157CE926
Course Instructor(s) Name	Dr. Abdul Hakim Salleh, USM, Malaysia
No. of Students Registered	34
No. of Students Eligible	30
No. of Students Pass	30

Sl.No.	VTU No	Name of the Student	Marks
1	10983	C.RAJESH	68
2	11738	MAIBAMYAIKHOMBAMEETE	53
3	11933	SANTASINAM	13
4	11934	LOUREMBAMERIC	65
5	11996	VANIPANTARAKESH	68
6	12035	TRAVINDRAN	68
7	12308	MONISHPRAVEEN	61
8	12584	MADASANIGNANA CHARANTEJA	55
9	13504	KANNAPATIRAGHUVAMSI	55

10	13916	MEKASUSHMA	55
11	13942	ANSHURAJ	71
12	13967	M.SELVAKUMAR	79
13	14059	PRAVEENKUMAR	71
14	15350	ASODIKUSUSMA HARIHARA	59
15	15376	JOVA JOHN	73
16	16220	GYANKUMARRAY	70
17	16273	NIRMALSUBEDI	70
18	16350	SUBODHKUMARYADAV	71
19	16832	THAGATAMAJUMDER	78
20	16881	VAKILAN	56
21	16911	DINESHSHARMAGURUMAYUM	75
22	16915	ROHENSINAM	69
23	16916	MUNGYAMBAHEISNAM	73
24	16943	BHOPENKANGUJAM	73
25	16974	SHAIKAFREEDBASHA	70
26	17003	KHANACHAOBAMLOYUIMBA	83
27	17449	B.BHAVANIPRASAD	55
28	17900	POLIMERA AKHIL	74
29	18656	DIPENDRASINGH	55
30	18710	SUJITHKUMARSHA KANU	64
31	11190	U.AAKASH	0
32	15242	NATHIRAJU	55
33	13413	BANDHARAPURAHUL	55
34	21666	LOLLAVENKATASAIVAISHNAVI	55

Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

Department of Civil Engineering

Name of the course : Cost Estimation and Quantity Surveying

Course code : 1157CE924

Course Faculty : Dr. Sharifah Ahamad

No of Students eligible : 20

No of Students attended: 21

No of Students pass : 19

Sl.No.	VTU No.	Name of the Student	Mark
1.	vtu12976	R.SaiKiran	90
2.	vtu13916	M.Sushma	70
3.	vtu13564	Juttiga Bhuvan Sriram	76
4.	vtu12279	E.Jithender Reddy	70
5.	vtu13413	Bandharapu Rahul	92
6.	vtu15242	Nathi Raju	0
7.	vtu12988	A.Chandra Mouli	90
8.	vtu14027	Ch.Sudha Kiran Teja	90
9.	vtu16210	Aayush KC	90
10.	vtu11972	Sentishilu Pongen	70
11.	vtu11927	Imlisunep Jamir	70
12.	vtu16499	K.Raja Mohan	90
13.	vtu14042	Vikas Dhangar	80
14.	vtu15186	Bondalapati Pradeep Kumar	86
15.	vtu11529	Inohuka Aye	70
16.	vtu13736	Narayanachari Annamalai	92
17.	vtu16242	Raju Ghimire	90
18.	vtu11190	U.Aakash	0
19.	vtu11738	Maibam Yaikhomba Meete	70
20.	vtu13958	Pasupleti Akhil Sai	90
21.	vtu16246	Ravi Jaiswal	80

STUDENTS' FINAL TEST SCORE

Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

Department of Civil Engineering

Course Title	LATEST TRENDS IN CONSTRUCTION
Course Code	1157CE924
Course Instructor(s) Name	Prof. Dr. Fan Su-Ling Tamkang University, Taiwan
No. of Students Registered	61
No. of Students Eligible	61
No. of Students Pass	61

Sl.No.	VTUNo.	Name	Test Score out of (100)
1	11076	CHINGAKDANTEDPPHOM	80
2	11077	VESUZORINGA	80
3	11078	HENDOK	80
4	11190	AAKASH.U	80
5	11798	CHRAJJEVKUMARSINGH	75
6	11802	KEYIGUMLUNGLEIHEILUNG	85
7	11885	KEVISEBINONAGI	75
8	11932	BIKUNAOREM	75
9	11934	LOUREMBAMERIC	75
10	11944	MOLOCHIT	85
11	11954	MISHALINDIENGGAN	80
12	11955	PYSANBORLANGROBERTSLYNGDOH	75
13	11970	ROHITKUMAR	85
14	12029	SHAHIDAFRIDSHAIK	60
15	12592	K BALAJI	90
16	13278	AKASH.M	85
17	13504	KANNAPATIRAGHUVAMSI	60
18	13551	SHAIKABDULSAMAD	80
19	13736	NARAYANACHARIANNAMALI	60
20	13810	JAMBEYTASHI	90
21	13935	AKURINAVEENREDDY	75
22	13942	ANSHURAJ	75
23	13959	BAGRACETYMPUIN	75

24	13965	NITISHKUMAR	80
25	13967	M.SELVAKUMAR	80
26	14040	N.TEJASWINIREDDY	60
27	14042	VIKASDHANGAR	88
28	14059	PRAVEENKUMAR	80
29	15122	PALAMUKHESHKUMAR	75
30	15156	PARIKSHITPRIYADARSHI	83
31	15173	FLINDERRAPSANG	80
32	15186	B.PRADEEPKUMAR	75
33	15278	CHMAHESH KUMAR	75
34	15433	K.SATYANARAYANA	75
35	15722	PARISIGANIVAMSIKRISHNA	75
36	15865	BHUMIREDDYSREENADHREDDY	80
37	15873	M.THARUNSAISIVAKRISHNAREDDY	75
38	16143	SURENDRAKUMARSAH	83
39	16192	DIPAKKHATRI	80
40	16210	AAYUSH.K.K	80
41	16213	SUNILKUMARYADAV	88
42	16220	GYANKUMARRAY	81
43	16222	NGIMSANGESHERPA	80
44	16225	ANUPOLI	92
45	16241	ANISHSHAH	85
46	16242	RAJUGHIMIRE	80
47	16246	RAVIJAIWAL	80
48	16252	RAMSHARANYADAV	80
49	16253	ARBINDKUMARYADAV	83
50	16259	RITESHKUNWAR	80
51	16261	MANOJKUMARYADAV	75
52	16262	DILISHKUMARYADAV	80
53	16264	DILIPKUMARYADAV	90
54	16269	SUJEETDHAKAL	85
55	16273	NIRMALSUBEDI	85
56	16350	SUBODHKUMARYADAV	80
57	16356	CHILLAAVINASH	75
58	16365	WINFIELDMARBANIANG	75
59	16499	KOPPANATHULARAJAMOHAN	75
60	18903	KAVIRIRAJABABU	80
61	18906	POOSALASHIVAMANI	75

ANNEXURE – 10

Results of End Semester Examinations –Summer and Winter Semester of AY 2021 -2022

Summer Semester of AY 2021 -2022								
Course Code	Course Name	Faculty Name	No. of Students Regd.	No. of Students appeared	No. of Students absent	No. of Students passed	No. of Students failed	Actual Pass%
1151CE107	Structural Analysis – I	Mr. R. Robert Singh	46	43	3	39	4	91
1151CE107	Structural Analysis – I	Mr. R.M. Saravanakumar	50	49	1	48	1	98
1151CE104	Engineering Mechanics	Dr. S. Samson	58	52	6	48	4	92
1151CE117	Estimation and Quantity Surveying	Mr. K. Cheran	52	52	0	51	1	98
1151CE116	Geotechnical Engineering – II	Mr. M. Bharath	50	50	0	50	0	100
1151CE116	Geotechnical Engineering – II	Dr. S. Selva Kumar	42	40	2	34	6	85
1151CE114	Surveying	Dr. S. Kandasamy	52	48	4	48	0	100
1151CE205	Applied Hydraulic Engineering	Mr. T. Nelson Ponnudurai	50	45	5	40	5	89
1151CE205	Applied Hydraulic Engineering	Ms. V. Yamini	49	46	3	41	5	89
1151CE202	Geotechnical Engineering – I	Dr. J. Logeshwari	64	64	0	60	4	94
1151CE110	Basics of Dynamics and Aseismic Design of Structures	Ms. D.G.S. Nivedha	15	11	4	11	0	100
1151CE109	Design of RC Elements	Dr. M. Vinod Kumar	48	46	2	42	4	91
1151CE109	Design of RC Elements	Mrs. S. Sivaranjani	48	47	1	41	6	87
1151CE113	Construction Materials and Techniques	Mr. J. Saravanan	53	48	5	48	0	100
1151CE201	Strength of Materials	Mr. R. Robert Singh	50	50	0	45	5	90.0

Course Code	Course Name	Faculty Name	No. of Students Regd.	No. of Students appeared	No. of Students absent	No. of Students passed	No. of Students failed	Actual Pass%
1151CE201	Strength of Materials	Mr. J. Rajesh	51	48	3	40	8	83
1152CE116	Construction Planning, Scheduling and Control	Mr. T. Udhaya Kumar	31	30	1	28	2	93
1152CE124	Highway Engineering	Dr. S. Selva Kumar	48	47	1	46	1	98
1152CE132	Hydrology	Mr. S. Baskar	32	31	1	31	0	100
1152CE136	Solid Waste Management	Dr. A. GeethaSelvarani	26	25	1	23	2	92
1152CE142	Engineering Geology	Dr. G. Kumar	36	35	1	34	1	97
1152CE117	Contract Law and Regulation	Mr. S. Baskar	36	32	4	29	3	91
1153CE107	Environmental Conservation	Dr. K. R. AswinSidhaarth	38	35	3	34	1	97
1154CE101	Resource and Energy Recovery from Waste	Dr. S. P. Saravanan	42	38	2	36	2	95
1154CE101	Resource and Energy Recovery from Waste	Dr. K. Tamilarasan	41	40	1	37	3	93
1154CE104	Building Materials	Ms. V. Yamini	48	47	1	47	0	100
1154CE104	Building Materials	Ms. A. Mahalakshmi	48	47	1	47	0	100
1154CE105	Construction Engineering	Mr. M. Sridhar	47	47	0	47	0	100
1154CE108	Application of Remote Sensing and GIS in Disaster Management	Dr. G. Kumar	41	41	0	40	1	98
1154CE107	Startup Essentials	Mr. J. Saravanan	42	42	0	36	6	86

Winter Semester of AY 2021 -2022								
Course Code	Course Name	Faculty Name	No. of Students Regd.	No. of Students appeared	No. of Students absent	No. of Students passed	No. of Students failed	Actual Pass%
1151CE110	Basics of Dynamics and Aseismic Design of Structures	Mr. M. Sridhar	14	14	0	8	5	57
1151CE106	Mechanics of Solids	Dr. S. Samson	33	32	0	26	6	81
1151CE106	Mechanics of Solids	Mr. J. Rajesh	35	27	6	18	9	67
1151CE115	Structural Analysis - II	Mr. K. Cheran	45	41	1	38	3	93
1151CE115	Structural Analysis - II	Mr. R. Robert Singh	46	42	3	39	6	93
1151CE116	Geotechnical Engineering – II	Dr. J. Logeshwari	31	29	2	20	11	69
1151CE116	Geotechnical Engineering – II	Mr. M. Bharath	33	30	3	22	8	73
1151CE105	Fluid Mechanics	Mrs. S. Sivaranjani	33	33	0	24	9	73
1151CE105	Fluid Mechanics	Dr. S. P. Saravanan	29	21	6	18	3	86
1151CE111	Design of Steel Structures	Mr. T. Nelson Ponnudurai	46	40	2	36	4	90
1151CE111	Design of Steel Structures	Ms. D.G.S. Nivedha	46	43	2	36	7	84
1151CE206	Environmental Engineering	Dr. K.R. AswinSidhaarth	45	43	2	39	3	91
1151CE206	Environmental Engineering	Dr. K. Tamilarasan	43	32	5	29	3	91
1151CE207	Concrete Technology	Mr. T. Udhayakumar	35	35	0	32	3	91
1151CE207	Concrete Technology	Ms. V. Yamini	33	31	0	28	3	90
1152CE119	Repair and Rehabilitation of Structures	Dr. S. Kandasamy	28	21	7	20	1	95
1152CE124	Highway Engineering	Mr. M. Sridhar	21	21	0	18	3	86
1152CE147	Design of Reinforced Concrete and Brick Masonry Structures	Dr. M. Vinod Kumar	30	28	0	28	0	100

Course Code	Course Name	Faculty Name	No. of Students Regd.	No. of Students appeared	No. of Students absent	No. of Students passed	No. of Students failed	Actual Pass%
1152CE129	Rural Water Supply and Onsite Sanitation	Dr. A. GeethaSelvarani	20	20	0	19	1	95
1152CE130	Water Resource and Irrigation Engineering	Mr. S. Baskar	22	21	1	21	0	100
1152CE112	Ground Improvement Techniques	Dr. J. Logeshwari	28	28	1	21	6	75
1152CE127	Railways, Airport, Docks and Harbour Engineering	Dr. S. Selvakumar	24	22	2	18	4	82
1152CE138	Remote Sensing and GIS	Dr. G. Kumar	20	18	2	18	0	100
1153CE105	Air Pollution Management	Mr. J. Jeganraj	23	20	2	20	0	100
1154CE104	Building Materials	Ms. A. Mahalakshmi	22	19	3	18	1	95
1154CE103	Construction Contracts	Dr. S. Kandasamy	17	16	1	14	2	88
1154CE105	Construction Engineering	Ms. V. Yamini	12	10	0	6	4	60
1154CE106	Green Technology and Smart Buildings	Dr. S. Selvakumar	12	12	0	12	0	100
1154CE107	Startup Essentials	Mr. J. Saravanan	15	14	0	10	4	71
1154CE108	Application of Remote Sensing and GIS in Disaster Management	Dr. G. Kumar	22	19	3	17	2	89



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University Estd. u/s 3 of UGC Act, 1956)

SCHOOL OF ELECTRICAL AND COMMUNICATION

MINUTES OF MEETING

38th BOARD OF STUDIES

on

24.09.2022

**DEPARTMENT OF ELECTRONICS AND
COMMUNICATION ENGINEERING**



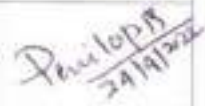
Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Approved by Government of Tamil Nadu on 12/07/2010

School of Electrical and Communication

Department of Electronics and Communications Engineering

Chapter Name : 38th BoS Meeting
Date/Time of Meeting : 24.09.2022 /10.00 a.m - 12.30 p.m
Location of Meeting : ECE Conference Hall

Members of Board of Studies

Serial Number	Name of the member	Designation	Signature
1	Dr.P. Esther Rani Professor and Head, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Chairman, Board of Studies	 24/9/2022
External Experts			
2	Dr.N.B. Balamurugan Professor, Department of Electronics and Communication Engineering, Thiagarajar College of Engineering, Madurai.	Academic Expert	 24/9/22
3	Ms. Penilop Scientist E, DSP Division, Sameer Centre for Electromagnetics, Chennai.	Industry Expert	 24/9/2022
4	Dr.G. Ramya, Assistant Professor, Department of Electronics and Communication Engineering, SRM Institute of Science and Technology, Chennai.	Alumni Representative	 24/09/22

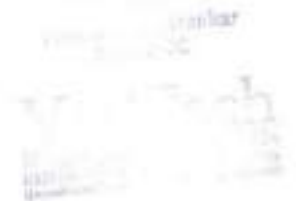
Internal Experts			
5	Dr. S. Jana Professor Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>Absent</i>
6	Dr. J.L. Mazher Iqbal Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>[Signature]</i>
7	Dr. E.D. Kanmani Ruby Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>[Signature]</i>
8	Dr. G. Aloy Anuja Mary Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>B. Aloy</i>
9	Dr. Harikrishna Paik Associate Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>[Signature]</i>
10	Dr.P. Kalpana Devi Associate Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>Kalpana</i>
11	Mrs.K.J. Subha Assistant Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	<i>[Signature]</i>

12	Dr. G. Gulothungan Associate Professor, Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Internal Member	
13	Gongal Reddy V Kishore Reddy Student (2020 - 2021), Department of Electronics and Communication Engineering, Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Student Representative	G.v.kishore Reddy


HOD/ECE


Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology


Dean/ECE


Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology

AGENDA – 38th BOARD OF STUDIES MEETING

Agenda No	Agenda
	Item for Confirmation
1	To confirm the minutes of meeting of the 37 th Board of Studies held on 18.02.2022
	Item for Reporting
2	New Courses offered under Ph.D. Course work Syllabi
3	New Courses offered under Industry/Higher Learning Institute category
4	New Courses offered under Independent Learning (MOOC) category
	Items for Discussion
5	Discussion on Vision, Mission, PEOs and PSOs of the department
6	Discussion on Program Structure, Curriculum and Syllabi in Program Core courses and Program Elective courses of VTR UGE 2021
7	Any other Points

The 38th BoS meeting started with a warm welcome by the Chairman of the BoS. Board Chairman appraised the new External BoS members about the department inception, programs offered and its achievements as we step into the year of silver jubilee, sanctioned intake, infrastructure, lab facilities, faculty competency, Students and faculty achievements. placement details and the academic performance of the students.

Agenda Item #1: To confirm the minutes of meeting of the 37thBoard of Studies held on 18.02.2022

Discussion #1

The BoS chairman briefed the action taken for the agenda points discussed in 37thBoard of Studies meeting held on18.02.2022 as given below

Agenda No.	Agenda
	Item for Confirmation
1	To confirm the minutes of meeting of the 36 th Board of Studies held on 27.06.2021
	Items for Reporting
2	New Courses offered under Institute Elective category
3	New Courses offered under Independent Learning (MOOC) category
4	New Courses offered under Industry/Higher Learning category
	Items for Discussion
5	Discussions on Ph.D. course work syllabi
6	Discussions on curriculum and syllabi in Program Core, Program Elective, Honors Elective, Specialization Elective, Minor Elective and Open Elective of VTR UGE 2021
7	Any other points

All the members reviewed the action taken for the points discussed above and suggested to move on to next agenda.

Action #1: Resolved, that the action taken for the points discussed in the 37th Board of Studies are hereby approved by the members of BoS and shall be finalized.

Agenda Item #2: New course offered New Courses offered under Ph.D. Course work Syllabi with the recommendations from internal BOS members

Discussion #2 : The BoS chair reported the syllabus of the newly offered PhD course 40211EC126 Wearable Security with the recommendations from internal BOS members for the PhD scholar during the previous semester.

Action #2: Resolved, that the inclusion of course in the PhD are hereby ratified by the members of BoS.

Agenda Item #3: New courses offered under **Industry/Higher Learning Category** with the recommendations from internal BOS members

Discussion #3 : The BoS chair reported the list of new courses offered under **Industry / Higher Learning Category** for the subjects 1157EC971 – Trends in Industrial IoT and 1157EC972 – Cybersecurity and Ethical Hacking with the recommendations from internal BoS members

- Action #3:** Resolved, that the inclusion of course new courses offered under **Industry / Higher Learning Category** for the subjects 1157EC971 – Trends in Industrial IoT and 1157EC972 – Cybersecurity and Ethical Hacking are hereby approved by the members of BoS.
- Agenda Item #4:** New course offered under Independent Learning / Self Learning (MOOC) category with the recommendations from internal BoS members
- Discussion #4 :** The BoS chair reported the new course 1156EC463 – Database Management System proposed under Independent Learning (MOOC) category with the recommendations from internal BOS members.
- Action #4 :** Resolved, that the inclusion of the course under Independent Learning (MOOC) category is hereby approved by the members of BoS.
- Agenda Item #5:** Discussion on Vision, Mission, PEOs and PSOs of the department

Vision of the Department

To be a centre of academic excellence through quality education and cutting edge research in the diversified fields of Electronics and Communication Engineering to meet the global challenges and produce high quality professionals

Mission of the Department

- M1** - To enrich the knowledge of graduate engineers for global requirements by promoting quality education through innovative pedagogical practices
- M2** - To create an ambience of academic excellence by engaging in cutting-edge research and undertaking collaborative projects with academia and industry
- M3** - To develop competence by inculcating human and moral values with leadership and professional skills

Programme Educational Objectives

- PEO1** - Our graduates will have in depth knowledge in mathematical and engineering concepts required to solve engineering problems in the analysis and design of Electronics and Communication Devices and Systems
- PEO2** - Our graduates will have the expertise to conceive, design, implement and operate the Engineering products for the societal and environmental problems
- PEO3** - Our graduates will have adequate technical skills and leadership qualities in the developmet of innovative solutions required in core and allied industries
- PEO4** - Our graduates will adapt to multidisciplinary environment using evolving techniques and achieve professional competence through higher education, research and lifelong learning
- PEO5** - Our graduates will communicate effectively, practice and promote ethical, environmental, health and safety standards in their profession.

Programme Specific Objectives

PSO1 - Apply the knowledge of Electronics and Communication Engineering to develop CDIO framework using modern engineering hardware and software tools to meet societal and industrial needs.

PSO2- Design and develop smart systems using Artificial Intelligence, Data Science and Cyber Security technologies.

Discussion #5 : The BoS chairman appraised the Vision, Mission, PEOs and PSOs of the department.

Action #5: The Vision, Mission, PEOs and PSOs of the department were discussed and approved.

Agenda Item #6: Discussions on new program structure, curriculum and syllabi in Program Core and Program Elective of VTR UGE 2021 with the recommendations from internal BoS members.

Discussion #6 : The BoS chair presented the new program structure, Curriculum and Syllabi of VTR UGE 2021 under Program Core and Program Elective. The suggestions given by the BoS members are as follows.

S.No.	Course Title	Suggestions by Members
1.	10211EC102 Analog Electronics	<ul style="list-style-type: none"> Unit I – To include overview of semiconductors Unit V – Multi vibrators may be removed
2.	10211EC103 Digital Electronics	<ul style="list-style-type: none"> Suggested to change the verbs used in COs Unit I – Suggested to include Number Systems
3.	10211EC104 Linear Integrated Circuits	<ul style="list-style-type: none"> CO3 and CO4 – Statements can be simplified
4.	10211EC105 Control Systems	<ul style="list-style-type: none"> Simplify CO2 Unit V – Title to be changed
5.	10211EC108 Communication Systems	<ul style="list-style-type: none"> Simplify CO4 Unit II – Course content may be reduced Unit II – Noise in AM and FM may be included Unit IV–QAM may be included Text Books: Reduce the number of text books and other books may be added under reference book
6.	10211EC109 Microprocessor and Microcontroller	<ul style="list-style-type: none"> Unit V – Title to be Changed
7.	10211EC110 Data Communication Networks	<ul style="list-style-type: none"> Unit I – ‘Introduction’ Term in title may be changed Unit V – may be mapped with K3 level

8.	10211EC112 Wireless Communication	<ul style="list-style-type: none"> • Unit I – Overview of SISO,SIMO,MISO may be included • Unit II – Beam Forming may be included
9.	10211EC113 Antenna Theory	<ul style="list-style-type: none"> • Unit III – Introduction may be removed • Unit IV – CODEC algorithm may be included under smart antenna design and implementation
10	10211EC114 VLSI Design	<ul style="list-style-type: none"> • Simulations to be included
11.	10211EC115 Optical and Microwave Communication systems	<ul style="list-style-type: none"> • Course content may be reduced as it is very vast
12.	10211EC201 Embedded OS and Device Drivers	<ul style="list-style-type: none"> • This course may be introduced in 5th Semester • Unit V – Syllabus may be elaborated • Add Reference Books
13.	10211EC301 Analog and Integrated Circuits Lab	<ul style="list-style-type: none"> • COs should be shortened • A/D and D/A converters, PLL, Differentiator and Integrated experiments may be included • Suggested to practice in ASL KV Kit 2010
14	10211EC303 Signals and Systems Lab	<ul style="list-style-type: none"> • To include MATLAB book by Sanjay Mithra in text books
15	10211EC305 Communication Lab	<ul style="list-style-type: none"> • Study experiments may be replaced
16	10211EC306 Optical and Microwave Engineering Lab	<ul style="list-style-type: none"> • CO1 – Design and Simulate term can be used • CO2 & CO4 – Statement may be framed shortly • Include ‘VI Characteristics’ of Gunn Diode
17	General Remarks	<ul style="list-style-type: none"> • Recent editions may be included in text books and reference books • COs should be brief.

Action #6: Resolved, that the curriculum and syllabi in Program Core of VTR UGE2021 are hereby approved by the members of BoS and shall be finalized after incorporation of the suggested modifications in the next BoS.

HoD / ECE

Dean / SoEC

Course Code	Course Title	L	T	P	C
10211EC102	ANALOG ELECTRONICS	2	2	0	3

a) **Course Category**

Program Core

b) **Preamble**

This Course provides the basic and design knowledge about electronic circuit analysis using BJT and MOSFET which involves feedback, oscillator, high frequency amplifiers and its applications

c) **Prerequisite**

Nil

d) **Related Courses**

Linear Integrated Circuits, Communication Systems.

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Explain the operation of basic semiconductor and its devices.	K2
CO2	Classify the performance of different biasing types used for transistor operation.	K2
CO3	Analyze the h parameters and small signal model for different transistor configuration	K3
CO4	Explain the effect of feedback, feedback amplifier and oscillators	K2
CO5	Illustrate the various types of tuned and power amplifiers.	K2

f) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	L	-	L	-	-	-	-	-	-	L	L	-
CO2	M	M	L	-	L	-	-	-	L	-	-	-	-	-
CO3	M	H	L	M	L	-	-	-	-	-	-	-	L	-
CO4	M	M	L	-	M	L	-	L	M	L	L	-	L	-
CO5	M	M	L	-	H	-	-	-	L	M	M	L	L	L

g) Course Content

UNIT I SEMICONDUCTOR DEVICES 12

Overview of semiconductor, PN Diode- Varactor diode, LED, PIN diode and Laser diode-Working principle and application of Zener diode- Rectifiers- Clipper and clamper-Basic principle and working SCR, UJT, IGBT.

UNIT II DC BIASING OF TRANSISTOR 12

Introduction–Working principle of BJT-Transistor characteristics-CB, CE, CC -Thermal runaway, thermal stability, DC Biasing-BJT: Fixed -Emitter-Stabilized-Voltage-Divider. Compensation techniques, Introduction-FET, MOSFET, Design of biasing for MOSFET.

UNIT III TRANSISTOR AMPLIFIER 12

Amplification in AC Domain, Two port system approach, The Hybrid Equivalent model, Approximate Hybrid equivalent circuit, Hybrid II model: CE, CC and CB configurations, Small signal analysis of MOSFET-Source follower, common source and common gate amplifier.

UNIT IV FEEDBACK AMPLIFIER AND OSCILLATORS 12

Basic concept of Feedback, Feedback connection types, Input and output impedance of feedback configurations. Characteristics of negative feedback, Oscillators: Principles of sinusoidal oscillator- RC oscillators: phase shift, Wienbridge. LC oscillators: Hartley, Colpitts, Clapp oscillator, crystal oscillator- oscillators design using LTspice.

UNIT V TUNED AND POWER AMPLIFIERS 12

Tuned amplifier: Analysis of single tuned, double tuned and stagger tuned amplifier. Power amplifiers: Transformer coupled Class A power amplifier, Class B amplifier operation, Transformer coupled Push pull circuits, Complimentary symmetry circuits, Class C power amplifier.

Total 60 Hrs

h) Learning Resources

Text Books

1. Boylestead & Neshelsky, Electronic Devices & Circuits, Pearson Education/PHI Ltd, 10th edition, 2010.
2. S.Salivahanan, N.Suresh Kumar and A.Vallavaraj, Electronic Devices and Circuits, McGraw-Hill, 3rd edition, 2012.
3. David .A. Bell, Electric Circuits And Electronic Devices Oxford University Press, 2010.

Reference Books

1. Behzad Razavi, “Design of Analog CMOS Integrated Circuits”, Tata McGraw-Hill, 2007.
2. Bapat K N, Electronic Devices & Circuits, McGraw Hill,1992.
3. J. and Halkias .C., Integrated Electronics,2nd Edition, Tata McGraw-Hill, 2001
4. Sedra&Smith, Microelectronic circuits, Oxford University Press, 5th ed.
5. Donald L.Schilling and Charles Belove, 'Electronic Circuits', Tata McGraw Hill, 3rd Edition,2003.
6. Dr. R. S. Sedha, A Textbook of Electronic Circuits, S. Chand, 2014.

Online Resources

1. www.nptel.ac.in
2. http://bitsavers.trailing-edge.com/pdf/national/_appNotes/AN-0088.pdf

Course Code	Course Title	L	T	P	C
10211EC103	DIGITAL ELECTRONICS	3	0	0	3

a) **Course Category**

Program Core

b) **Preamble**

The primary aim of this course is to understand the fundamental behind digital logic design and gain experience in using them for meeting any design specification. The course includes fundamentals of Boolean algebra, combinational and sequential circuits and introduction to HDL.

c) **Prerequisite**

Nil

d) **Related Courses**

Microprocessor and Microcontroller, VLSI design

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Illustrate the concept of Boolean minimization techniques and HDL.	K3
CO2	Apply the concept of Combinational circuits and write HDL Program for this circuits	K3
CO3	Apply the concept of sequential circuits for counters, shift registers etc. and write HDL program for this Circuits	K3
CO4	Solve asynchronous sequential circuits for simple application	K3
CO5	Explain the applications of digital electronics	K2

f) **Correlation of COs with POs**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	L	M	H	-	-	-	M	-	L	M	M	
CO2	H	M	L	L	H	-	-	-	M	-		M	L	
CO3	H	L	M	M	H	-	-	-	-	-	M	M	L	M
CO4	H	M	M	M	-	-	-	-	-	M	M	L	M	
CO5	H	L	M	L	-	-	-	-	-	M	L	-	L	L

g) **Course Content**

UNIT I DIGITAL FUNDAMENTALS AND COMBINATIONAL CIRCUITS 10

Number System; Boolean algebra and Switching Functions; Boolean Minimization using K Map and Tabulation method-NAND and NOR Realization- Introduction to Verilog – Structural, Dataflow and Behavioral modeling.

UNIT II combinational circuits 10

Design procedure – Half adder – Full Adder – Half subtractor– Full subtractor – Parallel binary adder/ Subtractor - Carry Look Ahead adder – Serial Adder/Subtractor – BCD adder – Binary Multiplier – Binary Divider – Multiplexer/ Demultiplexer – decoder – encoder – parity checker – parity generators – code converters – Magnitude Comparator , Structural, Dataflow and Behavioral modeling of combinational logic circuits (Multiplexer, Demultiplexer, decoder and encoder).

UNIT III SEQUENTIAL CIRCUITS 10

Flip Flops and Memory devices: RAM – Static and Dynamic, ROM, PROM, EPROM, EEPROM; Counters and Shift registers: Binary, BCD and programmable modulo counters, Shift register counters; Sequential circuit design: using Mealy and Moore model. Structural, Dataflow and Behavioral modeling of sequential logic circuits (counters and shift registers)

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 10

Analysis Procedure, Circuits with latches; Design Procedure, Reduction of state and flow table; Race free state assignment; Hazards; ASM chart; Design examples

UNIT V APPLICATIONS OF DIGITAL ELECTRONICS 5

Multiplexing displays – Frequency counters – Time measurements – using the ADC0804 – Slope alone operation, span adjust, zero shift, testing – microprocessor compatible A/D converters.

Total 45 Hrs

h) Learning Resources

Text Books

1. M. Morris Mano, Michael D Ciletti, Digital Design, 5th Edition, Prentice Hall of India Pvt. Ltd., Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2013.
2. Donald. P. Leach, Digital principles and applications, 7th Edition, McGraw-Hill, 2012
3. S.Salivahanan, S. Arivazhagan, Digital Circuits and Design, 5th Edition, Oxford University Press, 2018

Reference Books

1. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006.
2. Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003 Donald D.Givone, Digital Principles and Design, TMH
3. William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.

Online Resources

1. <http://www.wiley.com/legacy/wileychi/mblin/supp/student/LN08CombinationalLogicModules.pdf>
2. <http://www.learnabout-electronics.org>
3. www.nptel.com/digitalelectronics/iitkanpur/
4. www.mooc.org

Course Code	Course Title	L	T	P	C
10211EC104	Linear Integrated Circuits	3	0	0	3

a) **Course Category**

Program Core

b) **Preamble**

Linear Integrated Circuits introduces the basic building blocks of the Integrated circuits along with fundamental concepts of electronic circuits like operational amplifiers, rectifiers and timers and acquire the knowledge in the analysis and design IC based circuits.

c) **Prerequisite**

Analog Electronics

d) **Related Courses**

VLSI Design, Circuit Theory

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the basic principles, configurations and Practical limitations of Op-Amp	K2
CO2	Illustrate the various linear and non-linear applications of Op-Amp	K3
CO3	Manipulate different waveform generator circuits using op-amp, IC555 and analyze Active filters using op-amp	K3
CO4	Interpret the performance of various types of ADC and DAC using Op-Amp, PLL operation and its applications	K3
CO5	Illustrate various applications of special function Op-Amp ICs and discuss the impact of IC manufacturing	K3

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	L	L	L	L	L	L	L	M	L	-	L	L	-
CO2	H	M	L	L	L	L	L	L	M	L	-	L	L	-
CO3	H	M	M	-	L	L	L	L	M	L	-	M	L	-
CO4	H	M	M	L	L	M	L	L	M	L	-	M	L	-
CO5	H	M	M	M	L	M	M	M	M	M	L	M	L	-

g) Course Content

UNIT I INTRODUCTION AND CHARACTERISTICS OF OP-AMP 9

Op-amp: symbol, terminals, packages, specifications, Block diagram representation of op-amp, op-amp equivalent circuits, ideal op-amp and practical op-amp – open loop & closed loop configurations – DC and AC performance characteristics of op-amp: non-ideal characteristics, Differential amplifiers, CMRR concept, frequency response, slew rate and Power Bandwidth

UNIT II LINEAR OPERATIONAL AMPLIFIER CIRCUITS 9

Basic op-amp circuits: Inverting and Non-inverting voltage amplifiers, summing, scaling and averaging amplifiers, voltage follower, Instrumentation amplifiers (application oriented), V to I and I to V converters, Differentiators, Integrators – Non-Linear Wave shaping circuits: Clampers & Active Limiters – Non-Linear: Log and Antilog Amplifiers, Precision Rectifiers

UNIT III WAVEFORM GENERATORS, TIMER AND ACTIVE FILTERS 9

Comparator and its applications, Design: sine wave generators, square wave generators, triangle wave generators, saw tooth wave function generator – Barkhausen criterion – one-shot multi vibrators – 555 Timer IC – Waveform generators: using op-amp and 555 Timer Active Filters: Comparison between passive and active filter, Design: LPF, HPF and BPF

UNIT IV PLL AND A/D & D/A CONVERTERS 9

PLL: Phase detector, comparator, VCO, Purpose of PLL, Closed loop analysis of PLL, PLL applications and Frequency synthesizers – D/A conversion: DAC specifications, D/A

conversion techniques, Switches for DAC, weighted resistor DAC and R-2R Ladder DAC
– A/D conversion: ADC specifications, A/D conversion techniques Flash type ADC,
Monolithic ADC and Ramp type ADC

**UNIT V APPLICATIONS OF OP-AMP ICs AND IMPACT OF IC
MANUFACTURING**

9

Design and prepare documentation on the op-amp based circuits: Frequency Multiplier using IC 565, Transistor Amplifier Circuit-12 Watts, As a Phase Shifter, Infrared Motion Detector Circuit (LM 1458 op-amp, IR diode) – Impact of Integrated Circuit Manufacturing with regards to Environmental & Health risks – Recycling of scrap integrated circuits

Total: 45 Hrs

h) Learning Resources

Text Books

1. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits"- NewAge International Pvt. Ltd, 4th Edition,2011.
2. R. Gayakwad, Op-amps and Linear Integrated Circuits PHID. A. Bell,Solid state Pulse Circuits, PHI, 4th Edition,2009.

Reference Books

1. S. Franco, Design with Operational Amplifiers and Analog Integrated Circuits TMH, 3rd Edition, 2003.
2. R. F. Coughlin & F. F. Driscoll: Operational Amplifiers and Linear Integrated circuits, PHI, 1996.
3. D. A. Bell: Solid State pulse circuits, Milman Gravel: Micro-electronics, McGraw Hill, 3rd edition, PHI, 1991.

Online Resources

1. www.electronicstutorials.com
2. www.circuitstoday.com
3. www.nptel.com

Course Code	Course Title	L	T	P	C
10211EC105	CONTROL SYSTEMS	2	2	0	3

a) Course Category

Programme Core

b) Preamble

This course aims to provide a basic knowledge about what is a control system, its significance, transfer function, open and closed loop systems, mathematical model of electrical and mechanical systems, time domain and frequency domain analysis and its specifications, stability, design of compensators viz., lag and lead compensators, characteristics and significance of P, PI and PID controllers and State Space analysis.

c) Prerequisite

Signals and Systems

d) Related Courses

Linear Integrated Circuits, Analog Communication Systems

e) Course Outcomes

On successful completion of this course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Construct the transfer function model of electrical, mechanical, and Electromechanical systems.	K3
CO2	Determine the Time response of I order and II order systems for various test signals and analyze the stability of the given system using Root locus and Routh - Hurwitz criteria	K3
CO3	Examine the system stability by various methods such as Bode plot, Polar plot, and Nyquist plot in frequency domain	K3

CO4	Construct and Design controllers and compensators for Control System analysis in Frequency domain	K3
CO5	Apply the concept of State-Space for Control System Analysis	K3

f) Correlation of Co's with Po's

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	L	M	M	-	L	M	M	-	M	L	-
CO2	H	H	-	M	M	L	-	L	M	M	-	L	L	-
CO3	H	H	-	M	M	L	-	L	M	M	-	L	L	-
CO4	H	H	H	M	M	L	M	-	M	M	L	M	L	L
CO5	M	M	L	L	M	L	M	L	M	M	-	M	L	-

g) Course Content

UNIT I CONTROL SYSTEM COMPONENTS AND MATHEMATICAL MODELING 12

Basic elements of control system – open loop and closed loop systems: differential equation - transfer function, modeling of electric systems, translational and rotational mechanical systems - block diagram reduction techniques - signal flow graph - DC and AC servo Systems.

UNIT II TIME DOMAIN AND STABILITY ANALYSIS 12

Time response and Steady state response of first order systems and second order systems – System stability - dominant poles - Routh Hurwitz criterion: relative stability - Root locus Technique: Root loci, properties, and construction of root loci.

UNIT III FREQUENCY DOMAIN AND STABILITY ANALYSIS 12

Frequency response - correlation between time and frequency responses - Performance specification in frequency domain - Bode plot, Polar plot - Frequency domain specifications from the plots - Nyquist stability criterion - Nyquist plot.

UNIT IV DESIGN OF COMPENSATORS IN FREQUENCY DOMAIN 12

P, PI, PD and PID controllers: Introduction – transfer function model – characteristics; series, parallel and series - parallel compensation - Lead and Lag networks – Series compensator design for desired response using Bode diagrams.

UNIT V ANALYSIS USING STATE SPACE APPROACH

12

State variable representation – Canonical Realization - Conversion of state variable models to transfer functions - Conversion of transfer functions to state variable models - state transition Matrix - Solution of state equations - Concepts of Controllability and Observability – Concept of Stability in State Space approach.

Total 60 Hrs

h) Learning Resources

Text Books

1. M. Gopal, “Control System – Principles and Design”, Tata McGraw Hill, 2nd Edition, 2002
2. J. Magrath and M. Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2007.

Reference Books

1. Ogata, K., “Modern Control Engineering”, Prentice Hall of India Ltd., 4th Edition, New Delhi, 2006.

Course Code	Course Title	L	T	P	C
10211EC108	COMMUNICATION SYSTEMS	2	2	0	3

a) Course Category

Program Core

b) Preamble

This course provides an introduction about all types of analog modulation and demodulation techniques and applications. This course also provides the information about the baseband and passband transmission schemes, enabling the student to determine errors.

c) Prerequisite

Analog Electronics, Signals and System

d) Related Courses

Cellular Mobile Communication, Satellite Communication

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Characterize and design the behavior of amplitude modulation and detection schemes	K3
CO2	Design the various features of angle modulation and demodulation techniques and compare their performances	K3
CO3	Illustrate the influence of noise over communication systems through random process and noise theory	K2
CO4	Apply the concept of sampling and various wave form coding schemes.	K3
CO5	Apply the baseband transmission techniques and modulation schemes in pass band transmission.	K3

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	H	L	H	L	-	-	L	L	-	-	-	-	-
CO2	M	H	L	H	L	-	-	L	L	-	-	-	-	-
CO3	M	L	L	L	-	M	-	L	L	-	L	M	M	-
CO4	H	H	H	H	H	-	-	L	L	L	L	H	H	-
CO5	H	L	L	L	M	-	-	L	L	L	L	-	L	-

g) Course Content

UNIT I AMPLITUDE MODULATION

12

Modulation - Need for Modulation - Frequency Spectrum and Bandwidth, Need for Frequency Translation, Principles of Amplitude Modulation: AM Envelope - Modulation Index, AM Modulator: DSBSC- SSB- VSB Modulators, AM Transmitter, Comparison of AM Modulation Systems, AM Demodulators: AM Peak Detector -DSBSC- SSB, AM Receiver: TRF Receiver- Superheterodyne Receiver.

UNIT II ANGLE MODULATION

12

Phase and Frequency Modulation, Narrow Band and Wideband FM, Transmission Bandwidth of FM signals, FM Modulator: Generation of FM by Parameter Variation Method - Armstrong's Indirect Method, PM Modulator, FM Demodulator: Frequency Discriminator - Foster Seeley Discriminator - Balanced Slope Detector- FM Double Conversion Receiver.

UNIT III RANDOM PROCESS AND NOISE THEORY

12

Random Variables / Random Process, PSD Sequence of Pulse and Digital Data, Transmission of Random Process Through Linear Systems, Weiner Holph Filter, Noise: Shot Noise - Thermal Noise and White Noise - Narrow Band Noise - Noise Equivalent Bandwidth -Noise Temperature - Noise Figure, Noise in AM and FM Systems, Capture Effect – Threshold Effect.

UNIT IV SAMPLING PROCESS AND WAVE FORM CODING

12

Basic elements of a digital communication system-Sampling Theorem - Sampling and signal recovery -PAM, PCM- DPCM -Channel noise and error- Quantization Noise-SNR -DM- ADM- Linear prediction

Discrete PAM signals - Matched filter – Intersymbol Interference- Nyquist's criterion for Distortion less Transmission- Correlative coding –Baseband M-ary PAM systems -Adaptive Equalization-Eye patterns-Generation and Detection of ASK, FSK, PSK, DPSK, QPSK, QAM Comparison of digital modulation systems

Total : 60 Hrs

h) Learning Resources

Text Books

1. Simon Haykins, "Communication Systems", John Wiley, 4th Edition, 2006.
2. Herbert Taub, Donald L Schilling, and Goutam Soha "Principles of Communication Systems", Tata McGraw Hill, 4th Edition, 2014.
3. John G.Proakis, Masoud Salehi, "Digital Communication" McGraw Hill, 5th Edition, 2014

Reference Books

1. Wayne Tomasi "Electronic Communication Systems", Pearson education in south Asia, 5th Edition, 2011.
2. R. P Singh and S.D.Sapre "Communication Systems - Analog and Digital" Tata McGraw Hill, 3rd Edition, 2017.
3. John G. Proakis, Masoud Salehi "Fundamentals of Communication Systems" Pearson Education, 2nd Edition, 2013.
4. Bruce Carlson, "Communication Systems", Tata Mc Graw Hill, 3rd Edition, 2017.
5. Sam K.Shanmugam, "Analog& Digital Communication" John Wiley, 2006

Online Resources

1. <http://nptel.iitm.ac.in/courses/-0DataCommunication>
2. <http://www.sp4comm.org/docs/chapter12.pdf>
3. <http://www.talkingelectronics.com/Download%20eBooks/Principles%20of%20electronics/CH-16.pdf>
4. http://nptel.ac.in/courses/IITMADRAS/Principles_Of_Communication/pdf/Lecture23-24_AngleModulation.pdf

Course Code	Course Title	L	T	P	C
10211EC109	MICROPROCESSOR AND MICROCONTROLLER	3	0	0	3

a) **Course Category**

Program core

b) **Preamble**

The Purpose of the course is to provide students with the Knowledge of Microprocessors and Microcontroller. To solve real world problems in an efficient manner, this course also emphasis on architecture, Programming and system design used in various day to day gadgets.

c) **Prerequisite**

Digital Electronics

d) **Related Courses**

NIL

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Illustrate the functionalities of 8085 Microprocessor architectures and develop Assembly language programming.	K3
CO2	Illustrate the functionalities of 8086 Microprocessor architectures and develop Assembly language programming.	K3
CO3	Illustrate the functionalities of 8051 Microcontroller architectures and develop Assembly language and C programming.	K3
CO4	Review the operations of various peripheral devices such as 8255, 8253, 8251, 8279, 8259, 8237 and RTC.	K2
CO5	Explore the architectures and features of PIC and ARM Microcontrollers and generalize their applications using case studies.	K2

f) Correlation of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	H	M	M	L	H	-	-	L	L	L	-	-	M	M
CO2	H	M	M	L	H	-	-	L	L	L	-	-	M	M
CO3	H	M	M	L	H	-	-	L	L	L	-	-	M	H
CO4	M	L	-	-	-	-	-	-	L	L	-	-	M	-
CO5	M	L	M	-	-	-	-	-	L	L	M	M	M	M

g) Course Content

UNIT I 8085 MICROPROCESSOR

9

Introduction to 8085 Architecture, Addressing Modes, Instruction Formats, Instruction Set , Timing Diagram, memory mapping and Assembly Language Programming.

UNIT II 8086 MICROPROCESSOR

9

Introduction to 8086 Architecture, Features, Signals, Addressing Modes, Instruction Formats, Instruction Set, I/O and Memory Interfacing, Interrupts, Minimum Mode and Maximum Mode Operation, Assembly Language Programming.

UNIT III 8051 ARCHITECTURE

10

Hardware features, Architecture, Internal RAM structure, Special Function Registers, Addressing Modes, Instruction Set, Memory Organization, I/O Ports and Circuits, Timers, Interrupts, Interfacing of External Memory, Assembly Language Programming and C Programming.

UNIT IV PERIPHERAL DEVICES

9

Parallel Peripheral Interface (8255), Timer/Counter (8253), Serial Communication/UART (8251), A/D and D/A Interface, Keyboard and Display Controller (8279), Interrupt Controller (8259), DMA Controller (8237), Real Time Clock.

UNIT V PIC MICROCONTROLLER AND ARM PROCESSOR

8

PIC: Introduction, features, architecture, instruction set

ARM: Features and Classifications.

Case Studies PIC /ARM: Temperature Control System, Motor Speed Control System, Traffic light System, Elevator System, Data Acquisitions System.

Total Hours: 45 Hrs

h) Learning Resources

Text Books

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming and application with 8085, Penram International Publishing, 6th Edition, 2013.
2. A.K Ray & K.M. Burchandi, Advanced Microprocessor and peripherals Architectures, Programming and interfacing “, Third edition, Tata McGraw-Hill, 2013.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D McKinlay, The 8051 Microcontroller and embedded systems using assembly and C, second edition Pearson education Asia.
4. Danny Causey, Muhammad Ali Mazidi, and Rolin D. McKinlay "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", Pearson Education, 2008.
5. Muhammad Ali Mazidi, Sarmad Naimi, and Sepehr Naimi "AVR Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2014.

Reference Books

1. Kenneth J Ayala, The 8051 Microcontroller Architecture Programming and Application, Penram International Publishers, Third Edition.

Online Resources

1. <https://www.youtube.com/watch?v=liRPtvj7bFU&list=PL0E131A78ABFBFDD0>
2. <http://irist.iust.ac.ir/files/ee/pages/az/mazidi.pdf>
3. <https://www.youtube.com/watch?v=95uGOJ1Ud2c&list=PLJGA4olwzpA-rvcdWULcRuMn2495g0n8j>

Course Code	Course Title	L	T	P	C
10211EC110	DATA COMMUNICATION NETWORKS	3	1	0	3

a) **Course category**

Program core

b) **Preamble**

The purpose of this course is to provide the knowledge of fundamental concepts of networking, protocols, architectures and applications.

c) **Prerequisite**

Nil

d) **Related courses**

Network Security, Network Management, High Performance Communication Networks

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Interpret the fundamental concepts of data communication networks. Explain layered architecture of OSI and TCP/IP model.	K2
CO2	Summarize the various functions of data link layer and LAN architecture.	K2
CO3	Apply the knowledge of different types of switching and routing protocols.	K3
CO4	Outline the concepts of end to end process and application protocols	K2
CO5	Infer the Queuing model and advance switching concepts.	K3

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M		-	L	-	-	L	L	L	-	L	-	-
CO2	H	M		-	L	-	-	-	L	-	-	L	-	-
CO3	H	M	L	L	L	-	-	-	L	-	-	L	-	-
CO4	H	M		-	L	-	-	L	L	-	-	L	-	-
CO5	H	M	L	-	-	-	-	-	L	L	-	L	-	-

g) Course Content

Unit I Data Communication and Networking Devices 12

Evolution of data Networks-Network fundamentals: Data rate, Channel capacity, modes of communication, Line coding Techniques- Network Topologies- Categories of Networks- ISO/OSI Reference Model -TCP/IP Model-Networking and Inter Networking Devices: Repeaters, Hubs, Bridges, Switches, Routers,Gateways, Firewalls.

Unit II Data Link Layer & Local area Network 12

Logical Link Control –Types of error: single bit error- Burst error-Error Detection Techniques: CRC - checksum-Error Correction Technique: Hamming code – Transmission control protocol: ARQ protocols- Framing: HDLC-Medium Access Control: Random Access Protocols -Scheduling approaches to MAC. Ethernet: IEEE 802.3-Virtual LAN: IEEE 802.1Q- Wireless LAN: IEEE802.11-Bluetooth, Zigbee.

Unit III Switching & Routing Technologies 12

Circuit switching-packet switching-message switching-Internetworking- IP Addressing: IPv4 - Subnetting: classful-CIDR-IPv6-Routing: Distance Vector - Link State Routing Protocols.

Unit IV End-End Protocols and Security 12

Process-process delivery: Basics of Port addressing and Sockets- TCP, UDP and SCTP-TCP congestion control- Application protocols: WWW, HTTP, SMTP, FTP- Network security: HTTPs-SSL.

Unit V Queuing models & Advanced Switching 12

Markov chain theory - Queuing model basics and L - M/M/1 and its variants - M/G/1, G/M/1- applications of queuing model. Recent advances in Switching Approaches-Introduction to Software Defined Networking.

Total : 60 Hrs

h) Learning Resources

Text Books

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top Down Approach”, Pearson Publications, 5th Edition, 2012.
2. Behrouz A. Forouzan, “Data Communication and Networking” McGraw-Hill, 5th Edition, 2016.

Reference Books

1. William Stallings, “Data and Computer Communication”, Prentice Hall of India. Eighth edition. 2015.
2. Andrew S. Tanenbaum, Computer Networks, Prentice Hall.

Course Code	Course Title	L	T	P	C
10211EC112	WIRELESS COMMUNICATION	2	2	0	3

a) Course Category

Program Core

b) Preamble

This course addresses the fundamentals of wireless communication and provides an overview of existing and emerging wireless communications networks. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies, and various wireless networks, including past and future generation networks.

c) Prerequisite

Communication Systems

d) Related Courses

MIMO Wireless Communication, Cellular Mobile Communication

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Discuss the characteristics of wireless communication channels.	K2
CO2	Describe the diversity principles and MIMO concept in wireless communication	K2
CO3	Interpret the concepts of Multipath Mitigation Techniques.	K2
CO4	Explain multiple access techniques for Wireless Communication	K2
CO5	Describe the various wireless networks and give emphasis on trending technologies.	K2

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H	H	L	L	-	L	-	L	L	-	M	L	-
CO2	H	M	L	M	-	-	-	-	-	-	-	L	-	-
CO3	L	L	L	-	M	-	H	L	L	L	L	H	M	-
CO4	L	L	L	-	M	-	H	L	-	L	-	H	M	-
CO5	L	L	-	-	-	L	M	-	-	M	-	L	-	-

g) Course Content

UNIT I OVERVIEW OF WIRELESS CHANNEL 12

Overview of wireless communication, Cellular concept: Frequency reuse, Hand off, System capacity - Radio Propagation: Large scale path loss, Reflection, Diffraction, Scattering, Link Budget design - Small scale fading: Doppler shift, Time dispersion parameters, Coherence bandwidth, Doppler spread & Coherence time – Types of fading: Flat fading, Frequency selective fading, fast fading, slow fading.

UNIT II DIVERSITY TECHNOLOGIES & MIMO COMMUNICATIONS 12

Diversity- Receiver Diversity - Transmitter Diversity - SISO, SIMO, MISO, MIMO model: Parallel decomposition, channel capacity, Diversity Gain - Beam forming - Multiplexing trade-offs - Space-time Modulation and coding: STBC, STTC - Spatial Multiplexing and BLAST Architectures- MIMO Detection Techniques- Zero forcing and Maximum Likelihood detection.

UNIT III MULTIPATH MITIGATION TECHNIQUES 12

Equalization - Adaptive equalization - Linear and Non-Linear equalization - Zero Forcing, and Minimum Mean Square Error Algorithms - Diversity - Micro and Macro diversity - Diversity combining techniques - Error probability in fading channels with diversity reception - Rake receiver.

UNIT IV MULTI USER SYSTEMS 12

Multiple Access : FDMA, TDMA, CDMA, SDMA - Hybrid techniques - Random Access – ALOHA - Slotted ALOHA – CSMA – Scheduling - Power control - uplink-downlink channel capacity - multiuser diversity - MU-MIMO systems.

Evolution - 3G Overview - Migration path to UMTS - UMTS Basics - Air Interface - 3GPP Network Architecture - 4G features and challenges - Technology path - IMS Architecture- LTE architecture - Differences between IMS and LTE.

Total : 60 Hrs

h) Learning Resources

Text Books

1. Rappaport. T.S., “Wireless communications”, Pearson Education, 2nd Edition, 2010.
2. Andreas.F. Molisch, “Wireless Communications”, John Wiley – India, 2006.
3. Simon Haykin & Michael Moher, “Modern Wireless Communications”, Pearson Education, 2007.
4. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.
5. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007

Reference Books

1. Vijay. K. Garg, “Wireless Communication and Networking”, Morgan Kaufmann Publishers, <http://books.elsevier.com/9780123735805>;, 2007.
2. Sumit Kasera and Nishit Narang, “3G Networks – Architecture, Protocols and Procedures”, Tata McGraw Hill, 2007.
3. Kaveth Pahlavan,. K. Prashanth Krishnamurthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. Harry R. Anderson, “Fixed Broadband Wireless System Design” John Wiley – India, 2003.
5. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.

Online Resources

1. [http://nptel.iitm.ac.in/courses/-0Data Communication](http://nptel.iitm.ac.in/courses/-0Data%20Communication)
2. <http://www.sp4comm.org/docs/chapter12.pdf>
3. <https://nptel.ac.in/courses/117104099>

Course Code	Course Title	L	T	P	C
10211EC113	ANTENNA THEORY	2	2	0	3

a) Course Category

Program Core

b) Preamble

This course provides an introduction to the basic concepts of Radio Propagation in guided systems and to learn its application. The quality of signals at receiver depends on type of transmitting and receiving antennas, their orientation, transmitting frequency and geographical terrain. For installation & maintenance of wireless systems, the basic knowledge of wave propagation theory is essential.

c) Prerequisite

Electromagnetics and Transmission lines

d) Related Courses

Optical & Microwave Communication Systems, RF and Microwave Integrated Circuits

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Apply the propagation characteristics of guided waves between parallel planes, rectangular waveguide and circular waveguide.	K3
CO2	Explain the basic antenna parameters and various techniques involved in parameter measurements.	K2
CO3	Explain the design and operation of various types of antenna arrays.	K2
CO4	Apply the antenna characteristics to design various types of linear and planar antennas.	K3

CO5	Explain the knowledge of the structure of atmosphere, types of communication and propagation methods.	K2
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f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M	L	L	L	-	-	-	M	L	-	L	L	-
CO2	H	M	L	L	L	-	-	-	M	L	-	L	L	-
CO3	H	M	L	L	-	-	-	-	M	L	-	M	L	-
CO4	H	M	M	L	L	L	L	-	M	L	-	L	-	-
CO5	H	M	M	L	L	L	L	L	M	L	-	L	-	-

g) Course Content

UNIT I WAVE GUIDES

12

General Wave behaviours along uniform Guiding structures - Transverse Electromagnetic waves - Transverse Magnetic waves - Transverse Electric waves - TM and TE waves between parallel planes - TM and TE waves in Rectangular wave guides - Bessel's differential equation and Bessel function - TM and TE waves in Circular wave guides - Rectangular and circular cavity Resonators.

UNIT II ANTENNA FUNDAMENTALS

12

Basic antenna parameters: gain, directivity, beam solid angle, beam width and effective aperture calculations - Effective height - wave polarization - antenna temperature - radiation resistance - radiation efficiency - antenna field zones - principles of reciprocity - Duality of antennas - Concept of retarded potential - Field, directivity and radiation resistance of an infinite simile dipole - short dipole - half wave dipole - Measurement of radiation pattern – gain - directivity and impedance of antenna.

UNIT III ANTENNA ARRAYS

12

Two element Array - N-Element Linear Array : Uniform Amplitude and Spacing, Directivity, Design Procedure - Principle of pattern multiplication - N-Element Linear Array: Uniform Spacing and Non uniform Amplitude, Super directivity - Grating lobes - Planar Array - Design consideration: Design of Broadside, End fire & Binomial arrays, Design of Dolph Chebyshev arrays - Circular Array.

UNIT IV SPECIAL ANTENNAS

12

Principles of Horn - Parabolic dish antenna - Casse grain antenna - Travelling wave antenna - Principle and applications of V and rhombic antenna - Principle of Log periodic antenna array and Helical antenna - Rectangular Patch antenna - Antennas for mobile base station and handset - Phased Array antenna - Principle of smart antenna: CORDIC algorithm for DOA estimation.

UNIT V RADIO WAVE PROPAGATION

12

Radio wave propagation – Modes- structure of atmosphere- sky wave propagation- effect of earth's magnetic field- Ionospheric abnormalities and absorption- space wave propagation- LOS Distance - Field strength of space wave - duct propagation - VHF and UHF Mobile radio propagation - tropospheric scatter propagation - fading and diversity techniques.

Total : 60 Hrs

h) Learning Resources

Text Books

1. E.C. Jordan and K.G.Balmain “Electro Magnetic Waves and Radiating System, Pearson Education, 2nd Edition, 2015.
2. Warren L Stutzman and Gary A Thiele, “Antenna Theory and Design”, John Wiley and Sons, 2nd Edition, 2009.

Reference Books

1. A. Balanis, “Antenna Theory: Analysis and Design”, Wiley Publications. 3rd Edition, 2016.
2. John D Kraus, “Antennas for all Applications”, McGraw Hill, 3rd Edition, 2005.
3. Collin R.E, “Antennas & Radio Wave Propagation”, McGraw Hill. 1985.
4. Terman, “Electronics & Radio Engineering”, McGraw Hill, 4th edition.
5. Thomas A. Milligan, “Modern Antenna Design”, Wiley, 2nd ,Edition, 2005.
6. Constantine A.Balanis, P .Loannides, “Introduction to Smart Antennas”, Morgan & Claypool Publisher’s series, 1st Edition, 2007.

Online Resources

1. <http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Transmissionlines%20and%20EM%20Waves/TOC.html>.
2. <http://nptel.ac.in/courses/117101056>.
3. www.antenna-theory.com.
4. <http://www.dxzone.com/catalog/Antennas>
5. http://www.engr.sjsu.edu/rkwok/EE172/Antenna_Fundamental.pdf.

Course Code	Course Title	L	T	P	C
10211EC114	VLSI DESIGN	3	0	0	3

a) **Course Category**

Program Core

b) **Preamble**

This course introduces the fundamentals of the VLSI and implementation of digital circuit through the CMOS Transistors.

c) **Prerequisite**

Digital Electronics

d) **Related Courses**

Low power VLSI

e) **Course Outcomes**

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe CMOS logic implementation for combinational gates and VLSI design flow.	K2
CO2	Describe the CMOS fabrication and processing technology.	K2
CO3	Explain the I-V, C-V and DC characteristics of CMOS transistors.	K2
CO4	Construct the sequential circuits using CMOS transistors	K2
CO5	Illustrate the arithmetic building blocks and memories using CMOS circuits.	K2

f) **Correlation of COs with POs**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	M	M	L	L	L	-	-	-	-	-	-	H	-	-
CO2	M	L	M	M	L	-	L	-	-	-	-	L	-	-
CO3	M	L	L	M	L	M	-	-	L	-	-	L	-	-
CO4	H	M	M	H	M	L	-	-	-	-	-	L	L	L
CO5	H	M	H	H	M	L	-	L	L	L	-	H	L	L

g) **Course Content**

UNIT I CMOS LOGIC AND VLSI DESIGN FLOW 9

Review of MOS Transistors: nMOS, pMOS – Logic gates: CMOS Inverter – CMOS NAND Gate – CMOS NOR Gate – Compound Gates – Pass Transistor and Transmission Gates – Tristate – Multiplexers – VLSI Design Flow: Y-Chart.

UNIT II CMOS FABRICATION AND PROCESSING TECHNOLOGY 9

CMOS Fabrication and Layout: Inverter Cross Section – Layout Design Rules – Gate Layout – Stick Diagrams – CMOS Processing Technology: Background, Wafer Formation, Photolithography, Well and Channel Formation – SiO₂: Isolation, Gate Oxide, Gate and Source/Drain Formation – Contacts and Metallization – Passivation – Metrology.

UNIT III CMOS THEORY 9

MOS Transistor Theory – Ideal I-V Characteristics – C-V Characteristics – Non ideal I-V Effects – DC Transfer Characteristics: Static CMOS inverter DC characteristics, Beta ratio effect, Noise margin – Pass transistor DC characteristics.

UNIT IV SEQUENTIAL CIRCUITS 9

Sequencing Static Circuits – Circuit Design for Latches and Flip – Flops – Static Sequencing Element Methodology – Sequencing Dynamic Circuits – Synchronizer.

UNIT V ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURE 9

Adders: Single bit Addition, Carry-Ripple Adder, Carry Skip Adder, Carry-Look ahead Adder – Multipliers: Binary Multiplication, Array Multiplier – Shifters: Funnel Shifter source Generator, Funnel Shifter, Barrel Shifter – Comparator – Counters - Memories: one bit SRAM, one bit DRAM, Case study: Switch level modelling in Verilog HDL.

Total 45 Hrs

h) Learning Resources

Text Books

1. Neil H.E. Weste and David Money Harris, “CMOS VLSI Design: A Circuits and Systems Perspective”, Pearson Education, 4th Edition, 2015.
2. Douglas A. Pucknell and Kamran Eshraghian, “Basic VLSI Design”, PHI, 3rd Edition, 2017.
3. John.P.Uyemura, “Introduction to VLSI Circuits and Systems”, Wiley Publisher, 2006.

Reference Books

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, Digital Integrated Circuits: A Design Perspective”, Pearson, 2nd Edition, 2016.

Online Resources

1. www.nptelvideos.in/2012/12/digital-vlsi-system-design.html
2. <http://www.cmosvlsi.com/coursematerials.html>
3. <http://freevideolectures.com/Subject/VLSI-and-ASIC-Design> .

Course Code	Course Title	L	T	P	C
10211EC115	OPTICAL AND MICROWAVE COMMUNICATION SYSTEMS	2	2	0	3

a) Course Category

Program Core

b) Preamble

Fiber optic communication provides the basic concepts of optical fibers, light propagation, effect of losses and dispersion. Microwave Engineering enlightens the formulation of Scattering matrix for various microwave components and its properties, operation of solid state based devices, O and M tubes for microwave signal generation and illustrating different microwave measurement techniques.

c) Prerequisite

Antenna Theory

d) Related Courses

RF & Microwave Integrated circuits, Satellite Communication, Radar and Electronic Navigational system.

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Describe the basics of optical fiber's and its Mode Characteristics.	K2
CO2	Explain different losses, dispersion and distortion of light in optical fiber's.	K2
CO3	Apply the properties of S parameters to study the characteristics of microwave components.	K3
CO4	Explain the working principle of different solid state based devices.	K2
CO5	Describe the working principle of linear beam and cross field device and techniques used for measurements.	K2

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	M	L	L	L	L	L	L	L	L	L	L	L	-
CO2	H	H	L	L	M	L	L	L	L	-	M	L	L	-
CO3	H	H	M	H	H	L	M	L	L	L	-	L	M	L
CO4	M	M	L	L	M	L	M	L	L	-	-	L	-	-
CO5	M	M	L	M	H	M	M	L	L	L	M	L	L	-

g) Course Content

UNIT I OPTICAL FIBERS FUNDAMENTALS 12

Evolution of Fiber Optic Systems - Basic Optical Laws - Propagation of light inside fiber - Fiber Types - Splicing Techniques and Connectors - Losses: Attenuation Loss, Absorption Loss, Scattering Loss, Bending Loss, Core and Cladding Loss - Dispersion: Group-Delay, Material Dispersion, Pulse dispersion, Waveguide Dispersion, Intermodal Distortion. Dispersion Shifted Fibers, Dispersion Compensating Fibers- Modal analysis: Classification of modes.

UNIT II OPTICAL SOURCES, DETECTORS AND SYSTEMS 12

Intrinsic and extrinsic material-direct and indirect band gaps-LED structures-Surface emitting LED-Edge emitting LED-quantum efficiency and LED power - light source materials-modulation of LED- LASER diodes. Detectors: PIN photo detector, Avalanche photo diodes, Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects. System design consideration link design –Link power budget, WDM –Passive DWDM Components.

UNIT III MICROWAVE COMPONENTS AND TWO PORT NETWORKS 12

Microwave frequencies - advantages and applications, Scattering matrix formulation: Concept of N port scattering matrix representation - S parameters properties, Passive microwave devices: bends – corners – attenuators - phase changers, S Matrix Calculations for 2 port Junction: E plane and H plane Tees - Magic Tee - Faraday Rotation, Directional Coupler - Circulator and Isolator- Cavity resonators, Strip line & Micro stripline components.

UNIT IV MICROWAVE SOLID STATE DEVICES AND TUBES 15

Transit time limitations in Microwave Bipolar Transistors, Power frequency limitations Microwave Field Effect Transistors, Gunn effect: RWH theory - High-field domain and modes

of operation - microwave amplification, Avalanche transit time devices: IMPATT and TRAPATT diodes. Microwave vacuum tube based devices, Two cavity Klystron - velocity modulation – multi-cavity klystron - Traveling wave tube, Magnetron.

UNIT V MICROWAVE APPLICATIONS

9

Microwave applications in terrestrial and satellite communications, radar, remote sensing, wireless communications and their system requirements. Propagation modes of transmission lines- Planar Technology models, Modeling of discontinuities, junctions and circuits impedance transformers, Antenna, filters, solid state amplifiers and oscillators. Microwave computer aided design examples Using HFSS.

Total : 60 Hrs

h) Learning Resources

Text Books

1. John M. Senior , “Optical Fiber Communication”, Second Edition, Pearson Education, 2007
2. Samuel Y Liao, “Microwave Devices & Circuits” Third Edition Prentice Hall of India, 2006.
3. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India.2012.
4. Thomas H Lee, “Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits”, Cambridge University Press, 2004.
5. Mathew M Radmanesh, “RF and Microwave Electronics”, Prentice Hall, 2000.

Reference Books

1. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
2. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, 4th Edition., 2010.
3. R.E.Collin, "Foundations for Microwave Engineering", IEEE Press Citations, Second edition, 2000.
4. Annapurna Das and Sisir K Das, “Microwave Engineering”, TataMcGraw Hill Inc., Third edition. 2009.

Online Resources

1. https://en.wikipedia.org/wiki/Microwave_engineering
2. <http://www.microwaveeng.com>

Course Code	Course Title	L	T	P	C
10211EC201	EMBEDDED OS AND DEVICE DRIVERS	2	0	2	3

a) Course Category

Program Core

b) Preamble

This course teaches the fundamental concept of how operating system schedules the various embedded computational process in real time applications.

c) Prerequisite

Microprocessor and Microcontroller

d) Related Courses

Embedded Linux

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1.a	Explore the basic concepts of operating system and RTOS objects.	K2
CO1.b	Develop and simulate RTX51 based embedded OS code for 8051 microcontroller using Keil IDE and report on the code execution statistics by identify the time consuming module for optimization.	S3
CO2	Familiarize the concept of board support package.	K2
CO3	Describe the concept of embedded storage architecture.	K2
CO4.a	Explain various embedded file systems and storage space optimization techniques.	K2

CO4.b	Install Linux for specified configuration, develop Linux C programs and implement Linux file system.	S3
CO5.a	Illustrate the Linux device driver development process for communication interfaces and basic peripherals.	K2
CO5.b	Implement loadable kernel modules to be run in kernel space and develop Linux drivers for basic devices.	S3
CO6	Develop an RTOS based system to demonstrate a sustainable system incorporating the legal and safety standards while handling open source tools.	S3

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1.a	M	L	M		M							H		L
CO1.b				M	H			L	M	M	H		H	H
CO2	L		L		H								L	L
CO3	L		L		H								L	L
CO4.a	M											L		
CO4.b				M	H			L	M	M	H		H	H
CO5.a	L													
CO5.b			M	M	H			L	M	M	H	H	H	H
CO6	L	M	M		H	M	M	L	M	L	M		M	M

g) Course Content

UNIT I OVERVIEW OF RTOS

9

Introduction to OS, OS Structure, System Calls, RTOS Task and Task State, Scheduling – Preemptive and Non-preemptive, Process Synchronization, Inter Process Communication: Message Queues, Mailboxes, Pipes, Critical Section, Semaphores, Classical Synchronization Problem –Deadlocks.

UNIT II BOARD SUPPORT PACKAGES 5

Kernel build procedure, Inserting BSP in Kernel Build Procedure, Boot loader Interface, Memory Map, Interrupt management, PCI Subsystem: Timers - UART- Power Management.

UNIT III EMBEDDED STORAGE ARCHITECTURE 4

Embedded Storage: MTD – MTD Architecture - MTD Driver for NOR Flash - Flash Mapping Driver.

UNIT IV EMBEDDED FILE SYSTEM AND OPTIMIZATION 6

Embedded File System: RAMDisk – RAMFS – CRAMFS, Journaling Flash File Systems: JFFS and JFSS2, NFS: PROC File system, Optimizing storage Space: Kernel space optimization - Application Space Optimization, Applications for Embedded Linux - Tuning kernel memory.

UNIT V LINUX DEVICE DRIVERS 6

Embedded Drivers: Linux Device Model, Loadable Kernel Modules, Linux Serial Driver – function pointers, data flow, Ethernet Driver - I²C Subsystem on Linux - USB Gadgets.

Practical Exercises 30 Hrs

	CO	Skill Level
1 Exploring the features of Keil and RTX51	CO1.b	S3
2 Introductory Embedded C Programming	CO1.b	S3
3 Task Creation and Deletion using RTX51 in Keil	CO1.b	S3
4 Task scheduling using RTX51 in Keil	CO1.b	S3
5 Processing Critical Section using RTX51 in Keil	CO1.b	S3
6 Task Synchronization using RTX51 semaphores in Keil	CO1.b	S3
7 Task Communication using shared memory in Keil	CO1.b	S3
8 Linux Installation	CO4.b	S3
9 Basic Linux Programming	CO4.b	S3
10 Creating Linux Loadable kernel Modules	CO5.b	S3
11 Linux Serial Driver	CO5.b	S3
12 Mini Project	CO6	S3

Total : 60 Hrs

h) Learning Resources

Text Books

1. Silberschatz, Galvin, Gagne, “Operating System Concepts”, JohnWiley, 6th edition. 2003.
2. Raj Kamal, “Embedded Systems-Architecture, Programming and Design”, Tata McGraw Hill, 2006.
3. P.Raghavan, Amol Lad, Sriram Neelakandan, “Embedded Linux System Design and development”, Auerbach Publications 2005.

Reference Books

1. Jonathan Corbet, Allesandro Rubini & Greg Kroah-Hartman, “Linux Device Drivers”, O’Reilly, 3rd edition, 2005.

Online Resources

1. <https://www.youtube.com/watch?v=PEzpOembKNc>
2. <https://www.youtube.com/watch?v=mCs21yByQqk>

Course Code	Course Title	L	T	P	C
10211EC301	ANALOG INTEGRATED CIRCUITS LAB	0	0	4	2

a) Course Category

Program core

b) Preamble

The aim of this course is to understand the fundamentals and design of Analog electronic circuits using transistor, op-amp and MOS.

c) Prerequisite

Nil

d) Related Courses

Nil

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Skill Level As per Dave's Taxonomy
CO1	Operate, check and test electronic components using measuring equipment.	S3
CO2	Simulate, compare and analyze the electronic circuits using LT SPICE and through hardware implementation	S3
CO3	Illustrate the applications of demonstrated analog electronic circuits	S3

f) Correlation of COs with POs

	P O 1	P O 2	P O 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	H	H	M	M	M	-	-	-	-	L	-	L	M	-
CO2	H	H	M	M	M	-	-	-	-	L	-	L	M	-
CO3	H	H	-	M	-	-	-	-	-	L	-	L	M	-

g) Course Content

List of Experiments

[Design and testing of following Circuits and Simulation using LTSPICE]

Ex.No	List of Experiments	CO	Skill Level As per Dave's Taxonomy
1.	Design and implement Schmitt Trigger using op-amp	CO1, CO2, CO3	S3
2.	Design and implement Differentiator and Integrator using op-amp	CO1, CO2, CO3	S3
3.	Design an Instrumentation Amplifier using op-amp and calculate the CMRR.	CO1, CO2, CO3	S3
4.	Design an Active Low Pass and High Pass Filter using op-amp.	CO1, CO2, CO3	S3
5.	Design an Astable Multivibrator using 555 Timer using buzzer and LDR	CO1, CO2, CO3	S3
6.	Design and analyze Voltage Divider Bias and compare its performance with Fixed bias. Justify the same as Phase Splitter.	CO1, CO2, CO3	S3
7.	Design and test a Darlington Emitter Follower with and without bootstrapping.	CO1, CO2, CO3	S3
8.	Generate a desired frequency of LC Phase Shift Oscillator using BJT	CO1, CO2, CO3	S3
9.	Design a Complementary Symmetry Class B push Pull Amplifier	CO1, CO2, CO3	S3

10.	MOSFET as an amplifier with their frequency response	CO1, CO2, CO3	S3
11.	Design a CMOS inverter and plot its V-I Characteristics	CO1, CO2, CO3	S3
12.	Design a three stage Ring Oscillator using CMOS transistors	CO1, CO2, CO3	S3

Total : 60 Hrs

h) Learning Resources

Text Books

1. Boylestead & Neshelsky, Electronic Devices & Circuits, Pearson Education/PHI Ltd, 10th edition, 2010.
2. S.Salivahanan, N.Suresh Kumar and A.Vallavaraj, Electronic Devices and Circuits, McGraw-Hill, 3rd edition, 2012.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw-Hill, 2007

References

1. David .A. Bell, Electric Circuits And Electronic Devices Oxford University Press, 2010.Kumar,A. Vallavaraj.Bapat K N, Electronic Devices & Circuits, Mc Graw Hill, 1992.
2. J. Millman and Halkias .C, Integrated Electronics, 2nd Edition, Tata McGraw-Hill, 2001.
3. Donald L.Schilling and Charles Belove, Electronic Circuits, Tata McGraw Hill, 3rd Edition, 2003

Online Resources

1. <https://www.youtube.com/watch?v=kN2qA9W7W-A>
3. http://bitsavers.trailing-edge.com/pdf/national/_appNotes/AN-0088.pdf
4. <http://nptel.ac.in/courses/117106034/55>
5. <https://www.fairchildsemi.com/application-notes/AN/AN-88.pdf>
6. <http://nptel.ac.in/courses/117103063/34>

Course Code	Course Title	L	T	P	C
10211EC303	SIGNALS AND SYSTEMS LAB	0	0	2	1

a) Course Category

Program Core

b) Preamble

Signals & Systems laboratory course uses simulation software to demonstrate the generation and basic operations of signals like shifting, scaling and convolution etc. Students will also understand the applications of transformation techniques.

c) Prerequisite

Nil

d) Related Courses

Discrete Time Signal Processing, Digital Image and Video Processing

e) Course Outcomes

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Perform basic signal processing concepts on signals and systems.	S2
CO2	Implement transformation techniques to analyze signals & systems.	S2

f) Correlation of COs with POs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	H	H	H	H	H	-	M	M	H	M	-	H	H	M
CO2	M	M	H	H	H	-	M	M	H	M	-	H	H	M

g) Course Content

List of Experiments:

Experiment No.	Experiment Title	COs
MATLAB/SIMULINK based experiments		
1.	Generation of Signals	CO1
2.	Basic Operations on Signals	CO1
3.	Linear convolution of sequences and signals	CO1
4.	Auto correlation and cross correlation of sequences	CO1
5.	Properties of systems	CO1
6.	Fourier series representation of continuous time signals	CO1
7.	Fourier transform of continuous time signals	CO2
8.	Laplace transform of continuous time signals	CO2
9.	Sampling theorem	CO1
10.	Computation of Discrete time Fourier Transform	CO2
11.	Computation of DFT	CO2
12.	Z transform of discrete time signals	CO2
13.	System responses using SIMULINK	CO2
14.	Analysis of DT LTI systems using transforms	CO2
15.	Computation of frequency spectrum for the modulated signal	CO2

Total : 30 Hrs

h) Learning Resources

Text Books

1. Alex Palamides, Anastasia Veloni, "Signals and Systems Laboratory with Matlab", CRC Press, Taylor and Francis Group, London, New York, 2010.
2. Zahir M. Hussain, Amin Z. Sadik, Peter O'Shea, "Digital Signal Processing: An Introduction with MATLAB and Applications", Springer-Verlag, 2011.
3. John W. Leis, "Digital Signal Processing Using MATLAB for Students and Researchers", Wiley, New Jersey, 2011.
4. Samuel D. Stearns, Donald R. Hush, "Digital Signal Processing with Examples in MATLAB", Second Edition, CRC Press, New York, 2002.
5. Sanjit K Mitra, "Signals and Systems", First Edition, Oxford University Press, 2015

Online Resources

1. <https://in.mathworks.com/products/signal.html>
2. <https://grader.mathworks.com/>
3. <https://in.mathworks.com/products/matlab-grader.html>

Course Code	Course Title	L	T	P	C
10211EC305	COMMUNICATION LAB	0	0	2	1

a. Course Category:

Program Core

b. Preamble:

This course provides to demonstrate all types of modulation techniques for both analog and digital communication systems.

c. Pre-requisites:

Analog Electronics and Analog Communication Systems

d. Related Courses:

Nil

e. Course Outcomes:

Upon the successful completion of the course, students will be able to

CO Nos.	Course Outcomes	Skill Level (Based on Dave's Taxonomy)
CO1	Analyze the performance of AM and FM modulation and demodulation circuits.	S2
CO2	Visualize the effects of sampling, Error Control Codes, ASK, FSK, PSK, PAM, ISI, and Digital Modulation Techniques	S2
CO3	Analyze the performance of various digital modulation techniques, fading channel, and channel coding techniques.	S2
CO4	Acquire knowledge about network analyzers.	S2

f. Correlation of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	M	M	-	L	L	-	L	-	L	-	L	-
CO2	M	L	L	L	H	M	M	-	-	-	M	L	L	L
CO3	M	L	L	L	H	M	M	-	-	-	M	L	L	L
CO4	M	-	L	L	M	M	M	L	L	-	M	-	-	L

g. Course Content:

List of Experiments

S. No	Name of the Experiment	Course Outcomes
1	Design and testing of Amplitude Modulation and Demodulation. (Hardware)	CO1
2	Design and testing of Frequency Modulation and Demodulation. (Hardware)	CO1
3	Simulation of Sampling, Quantization, and Reconstruction of the signals.	CO2
4	Pulse code modulation and Demodulation of a signal.	CO2
5	Simulation and Performance Analysis of Binary ASK in a AWGN environment.	CO3
6	Analyze the process of Time Division Multiplexing and Demultiplexing (TDM)	CO3
7	Test the performance of the circuit for generation and detection of Amplitude shift keying. (Hardware)	CO3
8	Simulation and Performance Analysis of FSK in a AWGN environment.	CO3
9	Design and testing of FSK Modulation and Demodulation. (Hardware)	CO3
10	Simulation and Performance Analysis of Binary PSK in a AWGN environment.	CO3
11	Simulation and Performance Analysis of QAM in a AWGN environment.	CO3

12	Simulation and Performance Analysis of digital modulation technique in Rayleigh fading channel.	CO3
13	Simulation and Performance Analysis of digital modulation technique in fading channel with channel coding.	CO3
14	Performance analysis of monopole antenna using a network analyzer. (Hardware)	CO4
15	Design and test the performance of BPSK modulation using a Network Analyzer. (Hardware)	CO4

Course Code	Course Title	L	T	P	C
10211EC306	OPTICAL AND MICROWAVE ENGINEERING LAB	0	0	2	1

a) Course Category

Program core

b) Preamble

Optical and Microwave laboratory provides an opportunity to explore the concepts in optical devices and microwave systems in a laboratory setting with an emphasis on measurement techniques. The listed experiment provides the practical analysis of scattering matrix for various microwave components and its properties, operation of solid state based devices.

c) Prerequisite

Nil

d) Related Courses

Optical & Microwave Engineering.

e) Course Outcomes

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Skill Level(Based on Dave's Taxonomy)
CO1	Design and simulate the characteristics of microstrip transmission line, distributed elements, Tee junctions and couplers using ANSYS HFSS software.	S2
CO2	Setup microwave bench using Reflex klystron/ Gunn source, and study its characteristics.	S2
CO3	Design an appropriate length of fibre optic cable with less attenuation and dispersion and simulate the performance of the link using Opti performer tool.	S2
CO4	Explore the applications of Microwave Integrated circuits, devices and optical systems.	S2

f) Correlation of Cos with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	M	M	H	L	L	-	L	-	L	L	L	L
CO2	M	L	L	L	H	M	M	L	L	-	M	L	L	L
CO3	M	L	L	L	L	L	L	-	L	-	L	L	L	L
CO4	M	-	L	L	M	M	M	L	L	-	M	L	-	L

g) Course Content

List of Experiment

S.No.	Name of the Experiments	CO mapping of Experiments
1	Study of Ansys HFSS simulation tool	CO1
2	Design and analysis of a basic Microstrip transmission line using ANSYS HFSS Simulation Tool	CO1
3	Design and analysis of Rectangular Waveguide using ANSYS HFSS simulation Tool.	CO1
4	Design and Analysis of E-Plane and H-Plane T junctions using ANSYS HFSS simulation Tool.	CO1
5	Mode Characteristics of Reflex Klystron	CO2
6	Measurement of Radiation Pattern and Gain of Microwave Antenna	CO2
7	V-I Characteristics Of Gunn Diode	CO2
8	Measurement Of VSWR and Impedance Of Unknown Load	CO2
9	Modeling of a basic fiber optic system consisting of a transmitter, fiber and receiver using Optisystem	CO3
10	Design of an attenuation-Limited fiber length based on power budget system	CO3
11	Design of dispersion limited fiber length for a fiber optic transport system.	CO3
12	Determination Of Numerical Aperture of an Optical Fiber Cable	CO3
13	Study of Characteristics of LED and Photodiode	CO3
14	To explore the MMIC (Monolithic Microwave Integrated Circuit) Amplifier Characteristics. Measurement of gain, 1dB compression point, reverse isolation.	CO4



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
(Deemed to be University) Established under UGE Act, 1970

School of Computing
Department of Information Technology
35th Meeting of Board of Studies
Agenda

Date: 23-09-2022

Venue: IT Lab, B29, VTU

Agenda No	Agenda
35-BoS-01	Orientation of Revised Regulation VTR UGE – 2021
	Items for Consideration:
35-BoS-02	Ratification of previous BoS meeting minutes held on 30.06.2021
35-BoS-03	Discussion and approval of new curriculum and Syllabi of the following: B.Tech IT – Program Core, Elective, Open Elective B.Tech IT Specialization in Cloud Computing B.Tech IT Honors in Artificial Intelligence B.Tech IT Minor in Cloud Computing
35-BoS-04	Discussion on List of MOOC Courses
35-BoS-05	Ratification: courses offered under Industry / Higher Learning Institute Interaction category
35-BoS-06	Any other cognate item

I Items Recommended for Ratification

1. ITEM No: 35-BOS-2

1.1 Considered the 34th BoS minutes held on 26/02/2022 for Ratification.

It is resolved to recommend for ratification.

II Items Recommended for Approval

2. ITEM No: 35-BOS-3

Considered the curriculum and syllabi of Program core courses (shown in Annexure-I) of B.Tech IT Programme come into force from the academic year 2022-23 (Summer Semester) under VTR UGE – 2021 Regulations.

It is resolved to recommend for approval.

Considered the curriculum and syllabi of Program Elective courses (shown in Annexure-II) of B.Tech IT Programme come into force from the academic year 2022-23 (Summer Semester) under VTR UGE – 2021 Regulations.

It is resolved to recommend for approval.

Considered the curriculum and syllabi of Open Elective courses (shown in Annexure-III) of B.Tech IT Programme come into force from the academic year 2022-23 (Summer Semester) under VTR UGE – 2021 Regulations.

It is resolved to recommend for approval.

Considered the curriculum and syllabi of Elective courses (shown in Annexure-IV) of B.Tech IT Specialization in Cloud Computing come into force from the academic year 2022-23 (Summer Semester) under VTR UGE – 2021 Regulations.

It is resolved to recommend for approval.

Considered the curriculum and syllabi of Elective courses (shown in Annexure-V) of B.Tech IT Honors in Artificial Intelligence come into force from the academic year 2022-23 (Summer Semester) under VTR UGE – 2021 Regulations.

It is resolved to recommend for approval.

Considered the curriculum and syllabi of Elective courses (shown in Annexure-VI) of B.Tech IT Minor in Cloud Computing come into force from the academic year 2022-23 (Summer Semester) under VTR UGE – 2021 Regulations.

It is resolved to recommend for approval.

3. ITEM No: 35-BOS-4

List of MOOC courses, shown in Annexure-VII, for Independent Learning under VTUR15 Regulations.

It is resolved to recommend for approval

4. ITEM No: 35-BOS-5

Considered the courses, shown in Annexure-VIII, offered by a resource person from international office under the category of Industry/Higher Institute Learning Interaction as per VTUR15 Regulations for ratification.

It is resolved to recommend for ratification.

Chairperson, BoS in IT

Annexure – I

B.Tech IT Program core Course

Program Core	C	Program Core	C
Data Structures	3	Finite Automata Compiler Design	3
Computer Organization and Digital Design	3	Python Programming	3
Object Oriented Programming	3	Design and Analysis of Algorithm	3
Operating System	3	Data Structures Lab	1
Object Oriented Software Engineering	3	Design and Analysis of Algorithm Lab	1
Web Technology	3	Database Management System Lab	1
Database Management System	3	Web Technology Lab	1
Computer Networks	3	Computer Network Lab	1
Machine Learning	3	Object Oriented Programming Lab	1
Cloud Computing	3	Java Programming Lab	1
Java Programming	3	Operating Systems Lab	1
Cryptography and Network Security	3	Cloud Computing Lab	1
Internet of Things	3	Internet of Things Lab	1

Annexure II
Program Elective Courses

S.no	Program Elective
1	Big Data Analytics
2	Software Testing
3	Artificial Intelligence
4	Digital Image Processing
5	Data Science with Python
6	R Programming
7	Industrial IoT
8	Advanced Python Programming
9	Edge Computing
10	Virtualization
11	Mobile Application Development and Lab
12	Information Coding Techniques
13	Data Mining Techniques
14	Information Retrieval
15	Multimedia Systems
16	Distributed Computing
17	Mobile Adhoc Networks
18	Block Chain Fundamentals
19	Reinforcement Learning

Annexure III
Open Elective Courses

S.No	Open Elective
1	C++ Programming and Lab
2	Sql Fundamentals and Lab
3	Web Designing
4	Programming in java
5	Artificial Intelligence
6	Machine Learning
7	Internet of Things
8	Block Chain Fundamentals
9	Cloud Computing Fundamentals
10	Big Data Fundamentals
11	Computer Networks

Annexure IV

B.Tech IT Honors in Artificial Intelligence	
Courses	Credit
Artificial Intelligence	3
Neural Networks	3
Pattern Recognition	3
Language Processing	3
Deep Learning	3
Pattern Recognition Lab	1
Language Processing Lab	1
Deep Learning Lab	1

Annexure V

B.Tech IT Specialization in Cloud Computing	
Courses	Credit
Introduction to Virtualization and Cloud Computing	3
Cloud Deployment Models	3
Hadoop Platform and Application Framework	3
Big Data Essentials: HDFS, MapReduce	3
AWS Fundamentals	3
Hadoop and Spark Lab	1
Virtualization and Cloud Computing Lab	1
Cloud Computing Architecture Lab	1

Annexure VI

Minor Degree	
Cloud Computing	
Courses	Credit
Introduction to Virtualization and Cloud Computing	3
Cloud Deployment Models	3
Hadoop Platform and Application Framework	3
Big Data Essentials: HDFS, MapReduce	3
AWS Fundamentals	3
Hadoop and Spark Lab	1
Virtualization and Cloud Computing Lab	1
Cloud Computing Architecture Lab	1

Annexure VII

MOOC Course
AWS fundamentals:Migrating to cloud computing
The bits and bytes of Computer Networking
Algorithmic Tool box
UI PATH
The bits and bytes of Computer Networking
Algorithmic Tool box
Algorithmic Tool box
The bits and bytes of Computer Networking
Python Data structures
Introduction to Machine Learning
Getting Started with AWS Machine Learning
Algorithmic Tool box
AWS fundamentals:Migrating to cloud computing
Bitcoin and Cryptocurrency Technologies
AWS fundamentals:Migrating to cloud computing

Annexure VIII

Course offered by resource person from industry under the category industry / higher institute learning interaction [Section No.7.2.8 in VTUR15 Regulations].

Course 1:

Programme	:	B.Tech IT
Regulations	:	VTUR15
Course Title	:	10215IT101 -Design Thinking
Course Category	:	Industry / Higher Institute Learning Interaction
Course Faculty	:	Dr.Gayathire,Deputy Manager Talent Management at KONE Elevator India
Hours of Instruction	:	15
Credits	:	1
No.of Students	:	73

Course 2

Programme	:	B.Tech IT
Regulations	:	VTUR15
Course Title	:	1157IT916 - Concepts & Future Trends in Big Data & Data Science
Course Category	:	Industry / Higher Institute Learning Interaction
Course Faculty	:	Prof.Dr.R.Logeswaran ,City University,Malaysia
Hours of Instruction	:	15
Credits	:	1
No.of Students	:	44

Course 3

Programme	:	B.Tech IT
Regulations	:	VTUR15
Course Title	:	Data Compression Strategies: The Building Blocks
Course Category	:	Industry / Higher Institute Learning Interaction
Course Faculty	:	Prof.Dr.R.Logeswaran ,City University, Malaysia
Hours of Instruction	:	15
Credits	:	1
No.of Students	:	33



Minutes
of
23rd Meeting of the Research Board

Date: 24-09-2022

Time: 09.00 A.M

Venue: Video Conferencing Mode

(<https://meet.google.com/axg-xagt-pbs>)

Ref No: VTU / Research Board / 2022/ dt.24.09.2022

Date and Time : 24.09.2022 / 9.00 A.M – 10.000 A.M
Location of Meeting : Video Conferencing Mode
(<https://meet.google.com/axg-xagt-pbs>)

Members Present:

- | | |
|---|--|
| 1. Prof. Dr. S.Salivahanan | Vice Chancellor - Chairman |
| 2. Prof. Dr. E. Kannan | Registrar - Member |
| 3. Prof. . Dr. M.J. Carmel Mary Belinda | Dean, Academics (I/C) - Member |
| 4. Prof. Dr. E. Balasubramanian | Dean, R &D- Member |
| 5. Prof. Dr. V. Jayasankar | Dean, SoEC - Member |
| 6. Prof. Dr. N. Kumarappan | Annamalai University - Member |
| 7. Prof. Dr. S. Rajaram | Thiagarajar College of Engineering–Member |
| 8. Prof. Dr. R. Sivaraman | Controller of Examinations – Special Invitee |
| 9. Prof. Dr. S. Koteeswaran | Dean, Research Studies - Secretary |

Items for Discussion

Item No.: 23.1 To discuss and approve the grant of Exemption from Scopus Publication in respect of Ph.D. scholars and faculty members in the Department of English.

Discussion:

The Dean, Research Studies explained the difficulties involved in the scopus publication by the Department of English and sought grant of Exemption from Scopus Publication in respect of Ph.D. scholars and faculty members of the Department of English.

Action:

Most of the members have suggested that the relaxation may be permitted for case to case for Department of English. However, in case, if any other departments want to avail similar exemptions, they may submit valid documents to prove their difficulties in publishing scopus publications for discussion at Research Board to uphold the validity of the claim.

The Research Board resolved to grant exemption from scopus publication to the department of English and further resolved that the request for exemption from scopus publications from any other department in future, be decided based on case study and reality.

Item No.: 23.2 To discuss and approve the issuance of Transfer Certificate to all Ph.D. Scholars at the time of leaving the Institution / Completing the research programme.

Discussion:

The Dean, Research Studies presented the proposal of issuance of Transfer Certificate to all Ph.D. Scholars at the time of leaving the Institution / Completing the research programme similar to the practice of issuing transfer certificates in respect of other programmes.

Action:

At the end of the deliberations, the members have decided that issuance of TC for Ph.D. scholars is not advisable and feasible of compliance as well.

Further, it has been resolved to return the original PG Transfer certificate submitted by the research scholar on his leaving in the middle or at the end of the research programme.

Item No.: 23.3 To discuss and approve the Honorarium of Rs 10,000 /- per scholar to the Research Supervisor for their valuable service to guide the scholars after the award of degree.

Discussion:

The Dean, Research Studies presented the proposal of Honorarium of Rs 10,000 /- per scholar to the Research Supervisor guiding the scholars in future and the honorarium be paid after the award of degree.

Action:

The Board discussed elaborately on this subject and it is resolved to take up this matter with the higher authorities to explore the feasibilities of paying honorarium to the research supervisor at the first instance.

Item No.: 23.4 To discuss and approve the issuance of certificate in recognition and outstanding Ph.D. thesis award to the research scholars for publishing research articles in Q1 Journals.

Discussion:

The Dean, Research Studies presented the issuance of certificate and also outstanding Ph.D. thesis award to the research scholars for publishing research articles in Q1 Journals, as given in the Table 1.

Table 1: Certificate of recognition and outstanding Ph.D. thesis award to the research scholars.

S. No.	Description	Recognition
1	A Research Scholar has published TWO Journal papers related to his / her Ph.D. research work in Q1 Journal	Certificate of Recognition
2	A Research Scholar has published FOUR Journal papers related to his / her Ph.D. research work in Q1 Journal	Outstanding Ph.D. Thesis Award

Action:

The Board unanimously accepted the proposal and recommended for the issuance of certificate and recognition and outstanding Ph.D. thesis award to the research scholars for publishing research articles in Q1 with high impact factor Journals.

Items for Record

Item No.: 23.5 To approve and record the vacancy positions of Research Supervisor for Summer Session of the Academic Year 2022-23.

Discussion:

The Dean, Research Studies presented the research supervisor vacancy positions for Summer Session of the Academic Year 2022-23, as given in the Table 2.

Table 2: Research Supervisor vacancy positions for Summer Session of the Academic Year 2022-23.

DEPARTMENT	Research Supervisor Vacancy Positions
AERO	10
AUTO	10
CIVIL	12
MECH	156
IT	2
CSE	21
ECE	115
EEE	11
BIOTECH	26
BIOMEDICAL	14
ENGLISH	5
MATHS	65
PHYSICS	50
CHEMISTRY	44
LAW	0
MBA	0
TOTAL	541

Action:

The Board approved the Research Supervisor vacancy positions which are existing in various departments.

Item No.: 23.6 To approve and record the dates of Admission of Doctoral (Ph.D.) level Programmes in Engineering and Technology/ Science / Law/ Management / Arts for the Academic Year 2022 – 23.

Discussion:

The Dean, Research Studies presented the dates of Admission of Doctoral (Ph.D.) level Programmes in Engineering and Technology / Science / Law/ Management / Arts for the Academic Year 2022 – 23 and the details are given in Table 3.

Table 3: Important dates of Admission of Doctoral (Ph.D.) level Programmes in Engineering and Technology/ Science / Law/ Management / Arts for the Academic Year 2022 – 23.

Batch	Month & Year	Issue of Application	Last Date for Submission of Application	Entrance Examination	Interview	Certificate Verification and Admission
Summer Session	July 2022	01.04.2022	20.05.2022 30.05.2022	11.06.2022	22.06.2022	09.07.2022
Winter Session	January 2023	01.10.2022	20.11.2022	10.12.2022	21.12.2022	09.01.2023

Action:

The Board has discussed the dates of Admission of Doctoral (Ph.D.) level Programmes in Engineering and Technology/ Science / Law/ Management / Arts for the Academic Year 2022 – 23 and resolved that the schedule presented, be approved.

Item No.: 23.7 To approve and record the research scholars who are placed under DORMANT category for Winter Session of the Academic Year 2021-22.

Discussion:

The Dean, Research Studies presented the research scholars who are placed under DORMANT category for Winter Session of the Academic Year 2021-22 and the details are given in Table 4.

Table 4: Ph.D. Programme - Winter Semester of 2021-22 (WS 2122)–DORMANT Research Scholars

S.No.	Batch	VTD No.	Branch	Name of the Scholar	Mode of Study
1	2013 - 14	238	ECE	C.Malathi	PT-External
2	2013 - 14	296	ECE	Hari BabuDasari	PT-External
3	2014 - 15	346	Mech	Mohan K N	PT-External
4	2017 - 18	432	Civil	Sunildevajosh	PT-External
5	2017 - 18	455	EEE	SudharshanKottha	PT-External
6	2017 - 18	456	EEE	Santhosh Kumar Edukulla	PT-External
7	2017 - 18	460	ECE	Devendra O. Rapelli	PT-External
8	2017 - 18	465	ECE	T.Ramakrishnaiah	PT-External
9	2017 - 18	511	ECE	SivakalyaniPappuru	PT-External
10	2017 - 18	515	EEE	C.H.ShashiDhar	PT-External

11	2017 - 18	572	EEE	K.Sudarshan Reddy	PT-External
12	2017 - 18	573	EEE	SreekanthTummala	PT-External
13	2017 - 18	549	ECE	Ganga Ramesh	PT-External
14	2018 - 19	650	EEE	Immandi Solomon Raju	PT-External
15	2018 - 19	657	ECE	SateeshAmarneni	PT-External
16	2019 - 20	712	English	Manikandan R	PT-External
17	2019 - 20	724	Mech	Santhosh Kumar Rajamahendrarapu	PT-External
18	2019 - 20	738	Mech	Prashant Bharat Maitreya	PT-External
19	2019 - 20	757	CSE	M.Sakthivel	PT - Internal
20	2019 - 20	759	ECE	ThotaChaithanya	Full Time
21	2019 - 20	762	ECE	NareshBopparathi	PT-External
22	2019 - 20	776	MBA	KadhiriHareesh Kumar Reddy	PT-External
23	2020 - 21	833	CSE	NavakishorVadla	PT-External
24	2020 - 21	834	CSE	P Swathy	PT-External
25	2020 - 21	837	EEE	B Jagadeesh	PT-External
26	2020 - 21	850	ECE	T Chakrapani	PT-External
27	2020 - 21	852	ECE	G Krishna Murthy	PT-External
28	2020 - 21	901	Aero	Vinodh Kumar G	Full Time
29	2020 - 21	908	Civil	Aakavaram Raj Kumar	PT-External
30	2020 - 21	921	CSE	BudatiNagaveni	PT-External
31	2020 - 21	932	ECE	Mohammad Khadir	PT-External
32	2020 - 21	935	ECE	SushmaSuram	PT-External
33	2020 - 21	939	ECE	Kruttiventi A Manjusha	PT-External
34	2020 - 21	940	ECE	Pappathi N A	PT-External
35	2020 - 21	962	Mech	Ravichandran	PT-External
36	2020 - 21	977	MBA	M. Karthick	PT - Internal
37	2021 - 22	984	Chemistry	Paranthaman.S	PT-External
38	2021 - 22	992	CSE	Florence S	PT - Internal
39	2021 - 22	993	CSE	Sudhishna K S	PT-External
40	2021 - 22	995	CSE	NagendraBabuRajaboina	PT-External
41	2021 - 22	1014	Law	K.Sofiya	PT-External
42	2021 - 22	1015	Maths	G Arunachala Boopathy	Full Time

Action:

The subject pertaining to the placing of research scholars under Dormant category due to non completion of the process of semester registration, has been discussed and it has been resolved that these research scholars may be placed under DORMANT category.

Item No.: 23.8 To approve and record the list of research scholars whose Ph.D. registration has been cancelled during the Winter Session of the Academic Year 2021-22.

Discussion:

The Dean, Research Studies presented the list of research scholars whose Ph.D. registration has been cancelled during the Winter Session of the Academic Year 2021-22 and the details are given in Table 5.

Table 5: The List of Research Scholars – Cancellation

S. No.	VTD No.	Name of the Research Scholar	Dept.	Name of the Research Supervisor	Date of Admission (DD/MM/YYYY)	Batch No.	Mode of Study
1	955	K.Sujatha	MBA	Dr M Rajalakshmi	26.02.2021	38	PT-External
2	885	Raid Alhamad	MBA	Dr M S R Mariyappan	03.09.2020	37	Full Time
3	692	Manchala Priyamvadha	CIVIL	Dr J Logeshwari	12.07.2019	35	PT-External
4	694	Vishal ShivajiSherekar	CIVIL	Dr M Vinod Kumar	12.07.2019	35	PT-External
5	784	Neelam Raju	MBA	Dr P Elantheraiyan	10.01.2020	36	PT-External
6	802	Tarek Al Musalli	MECH	Dr Praveen A S	10.07.2020	37	Full Time
7	993	Sudhishna K S	CSE	Dr D Uma Nandhini	28.08.2021	39	PT-External

Action:

The Board considered the recommendation of the Dean (Research Studies) for the Cancellation of the Ph.D. Provisional admissions in respect of some scholars based on the reasons that some of the scholars left the institution and some of them are not willing to continue the research work.

It has been resolved to cancel registration of the scholars who have left the institution without completing the research work and those who are not willing to continue the research work.

Item No.: 23.9 To approve and record the status of research scholars who have submitted a synopsis / thesis since the last meeting.

Discussion:

The Dean, Research Studies presented the status of research scholars who have submitted a synopsis / thesis since the last meeting and the details are given in Table 6.

Table 6: The details of research scholars who have submitted a synopsis / thesis.

Sl. No.	VTD No.	Name of the Research Scholar	Dept.	Name of the Research Supervisor	Status
1	108	Sujatha.J	CSE	Dr R Kavitha	Synopsis
2	153	S.Karthick	CSE	Dr Gomathi N	Synopsis
3	187	Rameshkumar.T	EEE	Dr P Chandrasekar	Synopsis
4	191	Nandan.V	ECE	DrGowri Shankar Rao R	Synopsis
5	195	Mutharasan.A	EEE	Dr P Chandrasekar	Synopsis
6	242	Sumathi.P	CSE	Dr N Malarvizhi	Synopsis
7	261	C. AmbikaBhuvanewari	ECE	Dr E D Kanmani Ruby	Synopsis
8	314	N. VigneshPrasanna	ECE	Dr T Kavitha	Synopsis
9	355	Yogaraj	Mech	DrAmalajustusSelvam	Synopsis
10	371	Surrya Prakash D	Mech	Dr N Dillip Raja	Synopsis
11	458	V. Rafi	EEE	Dr P K Dhal	Synopsis
12	468	Balaji V	Mech	Dr N Lenin	Synopsis
13	536	WalunjkarGajananMadhavrao	CSE	Dr V Srinivasa Rao	Synopsis
14	538	AparnaShashikant Joshi	CSE	Dr M Shyamala Devi	Synopsis

15	592	A Suresh	CSE	Dr M J Carmel Mary Belinda	Synopsis
16	610	M.D.ThamaraiSelvi	English	Dr Saranya P	Synopsis
17	612	M.LakshmiPriya	Maths	Dr N Kalaivani	Synopsis
18	672	G.Muthumari	Maths	Dr.R.Narmada Devi	Synopsis
19	691	Cici Jennifer Raj J	Civil	Dr M Vinod Kumar	Synopsis
20	111	Jeena.R	CSE	Dr ThangaMariappan L	Thesis
21	286	Vinson Joshua.S	ECE	Dr SelvinMichPriyadharson	Thesis
22	356	Ganesh.R	Mech	Dr P Anand	Thesis
23	375	Kiran Kumar R	ECE	Dr S Shiyamala	Thesis
24	388	S.Vinoth John Prakash	EEE	Dr P K Dhal	Thesis
25	400	Pugazhenth N	Mech	Dr P Anand	Thesis
26	434	Ravi Kumar S	CSE	Dr E Kannan	Thesis
27	462	NarsaiahDomala	ECE	DrSasikala	Thesis
28	470	S.Jeba Rose Juliyana	Mech	Dr J Udaya Prakash	Thesis
29	486	Sai Suneel A	ECE	Dr S Shiyamala	Thesis
30	495	Reshma Begum Shaik	ECE	Dr Sasikala	Thesis
31	510	Mallikhaarjuna Rao S	ECE	Dr Sasikala	Thesis
32	550	Padma Jothi	ECE	Dr Mazher Iqbal	Thesis
33	615	Shankar Kumar S	MBA	Dr B Jeyaprabha	Thesis
34	622	M.Karthick	Mech	Dr P Anand	Thesis
35	628	Raja Beryl Alagu	Chemistry	Dr N Edayadulla	Thesis

Action:

The Board resolved to approve the status of research work in respect of the research scholars of various departments.

Item No.: 23.10 To approve and record the details of the research scholars, who have completed viva voce since the last meeting.

Discussion:

The Dean, Research Studies presented the details of the research scholars, who have completed viva voce since the last meeting are given in Table 7.

Table 7: The details of the research scholars – Completed Viva Voce Examination

S. No.	VTD No.	Name of the Research Scholar	Dept.	Viva-voce Date	Supervisor Name	Mode of Study
1	75	Uma.S	CSE	30.07.2022	Dr M J Carmel Mary Belinda	PT-External
2	126	Harish K A	MBA	26.04.2022	Dr B Jeyaprabha	PT- Ext (Group of Institution)
3	135	R.Lakshmi	EEE	20.01.2022	Dr K Karunanithi	PT-External
4	182	Prasanna.R	ECE	27.06.2022	Dr N M Masoodhu Banu	PT - Internal
5	192	Sharmila.P	ECE	06.09.2022	DrSelvinMichPriyadharson	PT - External
6	227	Rajalakshmi.D	CSE	10.06.2022	Dr N R Rajalakshmi	PT-External
7	240	Sugumaran D	CSE	22.04.2022	DrBharathi C R	PT - Internal
8	247	VenkatarameshLankapalli	CSE	11.06.2022	DrBharathi C R	PT-External
9	251	Geetha.A	CSE	03.08.2022	DrGomathi N	PT-External
10	272	SabeethaSaraswathi.S	CSE	11.03.2022	Dr N Malarvizhi	PT-External

11	281	Harish Pasupulati	ECE	21.04.2022	Dr S Baskar	PT-External
12	285	Kevinbenett	Aero	17.06.2022	Dr R Naren Shankar	PT-External
13	309	AanandhaSaravanan .K	ECE	27.04.2022	Dr P Suresh	PT - Internal
14	320	Senthil.V	Mech	09.09.2022	Dr E Balasubramanium	PT-External
15	366	KomalaDurga B	Maths	12.01.2022	Dr E Chandrasekaran	PT - Internal
16	383	Dileepan D	ECE	17.02.2022	Dr S Natarajan	PT - Internal
17	397	Hushein R	ECE	10.08.2022	DrBharathi C R	PT - Internal
18	399	Murali E	CSE	09.05.2022	Dr E Kannan	PT-External
19	426	Ramesh.V	Mech	13.07.2022	Dr P Anand	PT - Internal
20	435	Durai S	CSE	07.09.2022	Dr C Mahesh	PT - Internal
21	441	Thanjaiivadivel M	CSE	05.09.2022	Dr R Suguna	PT - Internal
22	459	R.Bharath Kumar	ECE	30.05.2022	Dr P Suresh	PT-External
23	469	Sundarraaj M	Mech	03.03.2022	Dr M Meikandan	PT - Internal
24	471	Thiruvengadam	Mech	13.06.2022	DrAnkurBansod	PT-External
25	473	LokhandeRamdas Alias PravinRavindra	Mech	01.03.2022	DrSachinSalunkhe	PT-External
26	542	P.Revathi	English	06.04.2022	Dr M R Bindhu	PT - Internal
27	554	Jayanthi K	CSE	17.09.2022	Dr C Mahesh	PT - Internal
28	579	JatharLaxmikantDattatray	Mech	18.07.2022	Dr S Ganesan	PT-External
29	587	Kirubakaran V	Aero	25.08.2022	Dr R Naren Shankar	Full Time
30	671	D Mary Jiny	Maths	09.03.2022	Dr. R. ShanmugaPriya	Full Time
31	677	K A Venkatesan	Maths	13.06.2022	Dr T Gunasekar	PT - Internal
32	400	Pugazhenth N	Mech	08.09.2022	Dr P Anand	PT - Internal

Action:

The Board resolved to approve and record the list of research scholars who have completed Viva Voce Examination.

Item for Ratification

Item No.:23.11 To approve and ratify the academic calendar for the summer and winter Session of the Academic Year 2022-23.

Discussion:

The Dean, Research Studies presented the academic calendar for the summer and winter Session of the Academic Year 2022-23 as in Table 8

Table 8: Academic Calendar

Academic Calendar		
Ph.D. Programme	Summer Semester	Winter Semester (Tentatively)
ADMISSION		
Issue of Ph.D. Application	01.04.2022	01.10.2022
Last Date for Submission of Application	20.05.2022	20.11.2022
Entrance Examination	11.06.2022	10.12.2022
Announcement of Entrance Examination Results	16.06.2022	15.12.2022
Interview	22.06.2022	21.12.2022
Certificate Verification and Payment of Fee	09.07.2022	09.01.2023
Issue of Provisional Admission Order	15.07.2022	13.01.2023
Date of reporting for the newly admitted Full Time scholars	24.07.2022	03.02.2023
Last date for Submission of Nomination of Research Advisory Committee (RAC) for the newly admitted scholars	05.09.2022	25.01.2023
Last date to conduct First RAC Meeting and Submission of Progress Review Form & Course Work Registration Form for the newly admitted scholars	10.10.2022	05.03.2023
SEMESTER REGISTRATION		
Semester Fee to be raised	15.09.2022	06.02.2023
Commencement of Semester Registration and Submission of Semester Progress Report for pursuing research scholars	19.09.2022	15.02.2023
Last date for Semester Registration	13.10.2022	10.03.2023
COURSE WORK AND DC / RAC MEETING		
Commencement of Course work registration through VLearn	26.09.2022	21.02.2023
Last date for Course Work Registration	13.10.2022	10.03.2023
Commencement of Course Work Classes	19.10.2022	15.03.2023
Last Instructional Day	19.01.2023	15.06.2023
Last date to conduct DC / RAC meeting and Submission of Progress Review Form for pursuing research scholars	19.01.2023	15.06.2023
EXAMINATIONS		
End Semester Examination Time Table notification	06.01.2023	06.06.2023
Commencement of End Semester Examination	24.01.2023	24.06.2023
Declaration of End Semester Examination Results	One month from the date of Last Examination	One month from the date of Last Examination
HOLIDAYS		
List of Public Holidays	As Per Tamil Nadu State Government Public Holidays	
Course work Classes may be offered as per the Ph.D. Regulations		
Commencement of the Next Academic Year (2023-24) is 24 th of July 2023 (Tentatively)		

Action:

The Board has resolved to ratify the academic calendar for the summer and winter Session of the Academic Year 2022-23.

Item No.: 23.12 To approve and ratify the decision taken with regard to recognition of faculty members to act as Research Supervisors as per the norms and Regulations.

Discussion:

Dean, Research Studies presented the list of faculty members who have submitted the applications for recognition of research supervisor and to consider them for Supervisorship to guide the Ph.D.scholars. The details of the submitted applications are given below in Table 9.

Table 9: Status of applications for supervisorship

S. No	Research Supervisor No	Name of the Research Supervisor	Dept.	Designation	Remarks
1	34908.AE.22	Dr J V Sai Prasanna Kumar	Aero	Professor	Eligible
2	34421.CV.22	Dr S P Saravanan	Civil	Assistant Professor	Eligible
3	35062.ME.22	Dr SumathyMuniamuthu	Mechanical	Professor	Eligible
4	34561.ME.22	Dr T Raja	Mechanical	Assistant Professor	Eligible
5	35163.ME.22	Dr R Ramesh Kumar	Mechanical	Assistant Professor	Eligible
6	35464.ME.22	Dr. Mathew Alphonse	Mechanical	Assistant Professor	Eligible
7	35357.CS.22	Dr G Tamilmani	CSE	Associate Professor	Eligible
8	36047.EC.22	Dr R Rajkumar	ECE	Associate Professor	Eligible
9	34644.EC.22	Dr A Bakiya	ECE	Assistant Professor	Eligible
10	34745.EC.22	Dr SanjoyDebnath	ECE	Assistant Professor	Eligible
11	35614.EE.22	Dr. K Vinoth	EEE	Associate Professor	Eligible
12	35946.EC.22	Dr David NeelsPonkumar D	ECE	Professor	Eligible
13	35208.BI.22	Dr R Ravikumar	Biotech	Professor	Eligible
14	34820.BS.22	Dr A Kathiravan	Chemistry	Associate Professor	Eligible
15	35718.BS.22	Dr S Karpagam	Maths	Assistant Professor	Eligible
16	35819.BS.22	Dr C Sarala Rubi	Physics	Assistant Professor	Eligible
17	35509.BS.22	Dr Murugavel S	English	Assistant Professor	Eligible
18	-	Dr Beulah Jackson	ECE	Professor	Not Eligible
19	-	Dr S Jagan	CSE	Professor	Not Eligible

20	-	Dr J Arun Pandian	CSE	Associate Professor	Not Eligible
21	-	Dr C T Dora Pravina	Maths	Associate Professor	Not Eligible

Action:

It is submitted that out of 21 faculty members, 17 have fulfilled the eligibility norms as per the guidelines of Ph.D. Regulations. i.e. S.No 1 to 17. The faculty members S.No. from 18 to 21 have not completed the norms. Therefore the faculty members from S.No. 18 to 21 are not considered for Supervisorship.

The Board resolved to approve 17 faculty members by virtue of completion of norms be approved to be the research supervisors and the faculty members (S.No. 18 to 21) shall not be considered as research supervisors for not fulfilling the norms.

Item No.:23.13 To approve and ratify the candidates who have been provisionally admitted to the Ph.D. Programme in Summer Session of the Academic Year 2022-23.

Discussion:

The Dean, Research Studies presented the details to ratify the Provisionally Admitted Candidates for the Ph.D. Programme in Summer Session of the Academic Year 2022-23 as given in Table 10 and 11.

Table 10: Statistics of Ph.D. National Admission Summer Session AY 2022-23

Statistics of Ph.D. National Admission Summer Session 2022-23

DEPARTMENT	Vacancy	Application			Entrance Exam		Interview		Provisionally Admitted				Gender	
		Applied	Shortlisted	Not Shortlisted	Exemption from Entrance Exam	Eligible for Entrance Exam	Selected for Interview	Selected in Interview	Full Time	Part Time Internal	Part Time External	Total	Male	Female
AERO	11	3	3	0	0	3	3	3	1	1	1	3	3	0
CIVIL	16	4	4	0	0	4	2	2	0	0	1	1	1	0
MECH	167	15	15	0	0	15	12	10	2	3	3	8	7	1
IT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CSE	28	31	31	0	0	31	20	13	1	5	7	13	6	7
ECE	121	19	19	0	0	19	14	13	1	1	8	10	9	1
EEE	13	5	5	0	0	5	4	3	0	3	0	3	3	0
BIOTECH	26	4	4	0	0	4	2	2	0	0	1	1	1	0
BIOMEDICAL	15	3	3	0	0	3	3	3	0	1	0	1	0	1
ENGLISH	8	12	9	3	5	1	8	6	5	1	0	6	6	0
MATHS	64	7	7	0	6	1	6	4	0	1	3	4	1	3
PHYSICS	47	3	3	0	1	2	1	1	0	1	0	1	1	0
CHEMISTRY	47	6	6	0	1	5	5	5	1	1	3	5	4	1
LAW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MBA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	563	112	109	3	13	93	80	65	11	18	27	56	42	14

Table 11: Statistics of Ph.D. International Admission Summer SessionAY 2022-23

Statistics of Ph.D. International Admission Summer Session 2022-23										
DEPARTMENT	Vacancy	Application			Mode of study	Selected for Interview	Provisionally Admitted	Country	Male	Female
		Applied	Shortlisted	Not Shortlisted	Full Time		Full Time			
AERO	11	0	0	0	0	0	0	Nil	0	0
CIVIL	16	2	2	0	2	2	1	Syria - 1	1	0
MECH	167	1	1	0	1	1	0	Nil	0	0
IT	0	0	0	0	0	0	0	Nil	0	0
CSE	28	2	1	1	1	1	0	Nil	0	0
ECE	121	0	0	0	0	0	0	Nil	0	0
EEE	13	1	1	0	1	1	0	Nil	0	0
BIOTECH	26	1	1	0	1	1	0	Nil	0	0
BIOMEDICAL	15	0	0	0	0	0	0	Nil	0	0
ENGLISH	8	0	0	0	0	0	0	Nil	0	0
MATHS	64	0	0	0	0	0	0	Nil	0	0
PHYSICS	47	0	0	0	0	0	0	Nil	0	0
CHEMISTRY	47	0	0	0	0	0	0	Nil	0	0
LAW	0	0	0	0	0	0	0	Nil	0	0
MBA	0	0	0	0	0	0	0	Nil	0	0
TOTAL	563	7	6	1	6	6	1	Syria - 1	1	0

Action:

The Board resolved to ratify the list of Provisionally admitted Candidates for the Ph.D. Programme in Summer Session of the Academic Year 2022-23.

Any other items with the permission of the Chairperson.**Item No.: 23.14 To discuss the proposal for offering Post Doctoral Programmes.****Discussion**

The members have discussed the feasibilities of starting the Post Doctoral Programmes in the Institution.

Action:

After an elaborate discussion, the Board suggested to frame the eligibility norms for guides and the post doctoral fellows and to submit the same for discussion at the the next meeting.

Item No.: 23.15 To discuss the Annual Report - Office of the Dean Research Studies - Academic Year 2021-22**Discussion**

With the permission of the Chairperson, the Dean Research Studies presented the Annual Report of the Annual Report - Office of the Dean Research Studies for the Academic Year 2021-22.

Action:

The Board resolved to approve the Annual Report of the Research Studies 2021-22.



Vel Tech
 Rangarajan Dr. Sagunthala
 R&D Institute of Science and Technology
 (Deemed to be University Estd. u/s 3 of UGC Act, 1956)

LATERAL ENTRY STUDENTS NAME LIST – SUMMER SEMESTER AY 22-23

S.No	UPDATED VTU NO	Name	Department
1	VTU23952	CHELLI KARTHIK	B.TECH - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
2	VTU23951	BALAJI T A	B.TECH - AERONAUTICAL ENGINEERING
3	VTU23954	OHMJAYADEVAR M	B.TECH - AERONAUTICAL ENGINEERING
4	VTU23978	MALLIREDDY.MADHUSUDHAN REDDY	B.TECH - AERONAUTICAL ENGINEERING with Specialization in Autonomous Drone technology
5	VTU23981	BHAVYA KUMAR SHARMA	B.TECH - ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE
6	VTU24093	D SHARON	B.TECH - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
7	VTU24094	P S JASWANTH	B.TECH - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
8	VTU24095	IYYAPPAN V	B.TECH - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
9	VTU24096	MADESHWARAN B	B.TECH - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
10	VTU23947	HARISHWAR. G	B.TECH - ARTIFICIAL INTELLIGENCE(AI) AND DATA SCIENCE
11	VTU23997	ANSILIN KUMAR S M	B.TECH - ARTIFICIAL INTELLIGENCE(AI) AND DATA SCIENCE
12	VTU24009	ABDUL KALAM A R	B.TECH - ARTIFICIAL INTELLIGENCE(AI) AND DATA SCIENCE
13	VTU23943	CHAPATI ADI MADHAVA REDDY	B.TECH - CIVIL ENGINEERING
14	VTU23988	KUNDETI DEVI SARASWATHI	B.TECH - CIVIL ENGINEERING
15	VTU24031	RAMALINGAM. V	B.TECH - CIVIL ENGINEERING
16	VTU24034	AITOK S WANGHU	B.TECH - CIVIL ENGINEERING
17	VTU24035	INTINONGBOU T CHANG	B.TECH - CIVIL ENGINEERING
18	VTU24038	AMAL KRISHNA	B.TECH - CIVIL ENGINEERING
19	VTU23948	THIRUMALAIVASAN E	B.TECH - COMPUTER SCIENCE AND DESIGN

20	VTU23964	KABILAN.B	B.TECH - COMPUTER SCIENCE AND DESIGN
21	VTU23949	GOKULAKRISHNA R	B.TECH - COMPUTER SCIENCE AND ENGINEERING
22	VTU23955	SHAIK KARIMULLA	B.TECH - COMPUTER SCIENCE AND ENGINEERING
23	VTU23957	AJIN	B.TECH - COMPUTER SCIENCE AND ENGINEERING
24	VTU23959	SHIVA YASWANTH REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING
25	VTU23963	YARRACHAGANTH SREENIVASA REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING
26	VTU23970	BOJJA GAGANRAJ	B.TECH - COMPUTER SCIENCE AND ENGINEERING
27	VTU23971	M JUSTIN PAULRAJ	B.TECH - COMPUTER SCIENCE AND ENGINEERING
28	VTU23972	AMARA SUNDEEP KUMAR	B.TECH - COMPUTER SCIENCE AND ENGINEERING
29	VTU23980	NIKHIL KUMAR SHARMA	B.TECH - COMPUTER SCIENCE AND ENGINEERING
30	VTU23985	CHITTURI GANESH	B.TECH - COMPUTER SCIENCE AND ENGINEERING
31	VTU23989	GUNTURU MALLIKHARJUNARAO	B.TECH - COMPUTER SCIENCE AND ENGINEERING
32	VTU23990	KUCHIPUDI VIJAY	B.TECH - COMPUTER SCIENCE AND ENGINEERING
33	VTU23996	BHOGADI VENKATA SAI TEJA	B.TECH - COMPUTER SCIENCE AND ENGINEERING
34	VTU23998	VIPRAPATNAM VENKATA RAO	B.TECH - COMPUTER SCIENCE AND ENGINEERING
35	VTU24013	SAUMY SAURAV	B.TECH - COMPUTER SCIENCE AND ENGINEERING
36	VTU24015	SHIVPUJAN KUMAR	B.TECH - COMPUTER SCIENCE AND ENGINEERING
37	VTU24022	BURAN MAHAMMAD SOHAIL	B.TECH - COMPUTER SCIENCE AND ENGINEERING
38	VTU24036	DHARUN P	B.TECH - COMPUTER SCIENCE AND ENGINEERING
39	VTU24037	BOLLA SHIVARAM	B.TECH - COMPUTER SCIENCE AND ENGINEERING
40	VTU24047	AMAN KHAN	B.TECH - COMPUTER SCIENCE AND ENGINEERING
41	VTU24048	MD MUSTAFA	B.TECH - COMPUTER SCIENCE AND ENGINEERING
42	VTU24049	YALLA RITHIK	B.TECH - COMPUTER SCIENCE AND ENGINEERING

43	VTU24055	DIGUMARTHI UDAYKIRAN	B.TECH - COMPUTER SCIENCE AND ENGINEERING
44	VTU24057	AJITHKUMAR V	B.TECH - COMPUTER SCIENCE AND ENGINEERING
45	VTU24062	PATAN AHAMMAD BASHA	B.TECH - COMPUTER SCIENCE AND ENGINEERING
46	VTU24063	PATHAKOTA BHARATH KUMAR REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING
47	VTU24064	GUDURU HEMANTH KUMAR REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING
48	VTU24069	UTTARKAR PAVANI BAI	B.TECH - COMPUTER SCIENCE AND ENGINEERING
49	VTU24100	KARTHIKIEN	B.TECH - COMPUTER SCIENCE AND ENGINEERING
50	VTU24007	KAKUMANU LEELA VENKATA KARTHIK	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE
51	VTU24027	BANKA VENKATESWARLU	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE
52	VTU24028	MALLAVARAPU VISWESWARA REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE
53	VTU24083	DHAMA JAYA CHANDRA	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE
54	VTU23940	HARISH	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
55	VTU23983	B YASWANTH KUMAR REDDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
56	VTU24016	VAIDEHI	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
57	VTU24052	MUNDRU SAI SANDEEP	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
58	VTU23974	JAKKA MAHENDER	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
59	VTU23995	MALLELA GNANESWAR	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

60	VTU23999	MARRIVADA TARAKESWAR	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
61	VTU24004	SHAIK RIYAZ	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
62	VTU24008	PAILA RUKESH KUMAR	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
63	VTU24021	KUNCHA CHARAN	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
64	VTU24056	MULA GOVARDHAN REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
65	VTU23946	GOKULNAATH	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY
66	VTU24042	AYUSH VERMA	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY
67	VTU24043	PRIYANSHU DAHAKE	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY
68	VTU24087	MORIPALLI SOURAV	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN DATA SCIENCE
69	VTU24014	SAURAV KUMAR	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN IOT AND CYBER SECURITY INCLUDING BLOCK CHAIN TECHNOLOGY
70	VTU23966	AVULA MAHESWARA REDDY	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECILIZATION IN CYBER SECURITY
71	VTU23950	GAVASKAR G	B.TECH - COMPUTER SCIENCE AND ENGINEERING WITH SPECILIZATION IN IOT and CYBER SECURITY including BLOCK CHAIN TECHNOLOGY
72	VTU23976	PASAM VENKATA SUSANTH	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING
73	VTU23992	D.PRUDHVIRAJ	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING

74	VTU24002	VELLANKI SHASHIDHARA CHARY	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING
75	VTU24005	KATEPOGU AJAY KUMAR	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING
76	VTU24030	MEDARAVOINA RISHITH	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING
77	VTU24058	GUNDOJI KEERTHI	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING
78	VTU24072	MAILAVARAPU SAI KIRAN	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING
79	VTU23962	ARSHADHYADAV K	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
80	VTU24044	MOHAMMED ISMAIL AHMED	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
81	VTU24067	PAVAN S	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
82	VTU24076	KALAVALAPUDI AKHIL	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
83	VTU24084	MULUMUDI HAREESH	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
84	VTU24088	THALLURI VENKATA KARTHIK	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
85	VTU24090	PARADARAMI VAMSIDHAR	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
86	VTU24091	SHAIK MANSOOR	B.TECH - ELECTRICAL AND ELECTRONICS ENGINEERING WITH SPECIALIZATION IN COMPUTER SYSTEMS
87	VTU23941	RAJESH S	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
88	VTU23944	S.VIGNASHVAR	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
89	VTU23960	MADITHATI SIVA CHANDRA LEKHA	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
90	VTU23961	RANJITH KUMAR	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
91	VTU23967	DONTU RAHUL	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
92	VTU23969	DHANUSH P	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING

93	VTU23975	PASUPULETI PRASANNA KUMARI	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
94	VTU23994	YARRAMSETTY LAKSHMAN AJAY KUMAR	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
95	VTU24011	PALLAPU VENKATA TEJA	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
96	VTU24017	SUGUMAR.T	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
97	VTU24018	CHALLA AMAR NATH REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
98	VTU24019	NIMMAKAYALA YASWANTH KUMAR REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
99	VTU24029	DRONADULA SAI SIVA GANESH	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
100	VTU24053	PEDDOJU Y K S NAGA MANIKANTA	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
101	VTU24054	A. HEMANTH	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
102	VTU24065	TELLAMEKHALLA BHARATH KUMAR	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
103	VTU24066	DASAMANENI GAURAV	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
104	VTU24070	GEDELA RAM PRASAD	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
105	VTU24075	SARAGADAM GNANESWAR	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
106	VTU24077	KARREDDULA SUDHARSHAN REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
107	VTU24079	VANIPENTA RAGHUNATH REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
108	VTU24080	DHAMA GNANENDRA	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
109	VTU24081	REDDYVARI SHIRISHA REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
110	VTU24092	SHAIK KHALID BASHA	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
111	VTU24098	PEDDAKOTLA LOKESWAR REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
112	VTU24102	SHUBHAM GOLDER	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
113	VTU24104	KOSURU LALITH SAI	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING
114	VTU24024	YADAMAKANTI ASHOK REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

115	VTU24103	D C GOVARDHAN REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
116	VTU23945	CHILAKAPATI SAI TULASI VEERENDRANADH	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
117	VTU24010	KATAMREDDY POOJITHA REDDY	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
118	VTU24050	KURAKULA NAGA NEELIMA	B.TECH - ELECTRONICS AND COMMUNICATION ENGINEERING WITH SPECIALIZATION IN CYBER SECURITY
119	VTU23956	JEEVAN KUMAR R	B.TECH - INFORMATION TECHNOLOGY
120	VTU23965	ARAVIND G	B.TECH - INFORMATION TECHNOLOGY
121	VTU23968	V SURIYANARAYANAN	B.TECH - INFORMATION TECHNOLOGY
122	VTU24020	SABALIL DAS	B.TECH - INFORMATION TECHNOLOGY
123	VTU24032	ABHINAV	B.TECH - INFORMATION TECHNOLOGY
124	VTU23958	MADDU RAGHU	B.TECH - MECHANICAL ENGINEERING
125	VTU23973	NIMMAKANTI SRAVAN KUMAR	B.TECH - MECHANICAL ENGINEERING
126	VTU23982	ABHAY HALDER	B.TECH - MECHANICAL ENGINEERING
127	VTU23984	J AKASH KUMAR	B.TECH - MECHANICAL ENGINEERING
128	VTU23991	VASAGIRI MANI DEEPAK	B.TECH - MECHANICAL ENGINEERING
129	VTU23993	RAJARISHI H P	B.TECH - MECHANICAL ENGINEERING
130	VTU24001	T NAVEEN VAMSI	B.TECH - MECHANICAL ENGINEERING
131	VTU24003	KAMAL K	B.TECH - MECHANICAL ENGINEERING
132	VTU24006	B. NITISH	B.TECH - MECHANICAL ENGINEERING
133	VTU24026	ARUN KUMAR	B.TECH - MECHANICAL ENGINEERING
134	VTU24039	GURUMALLAIYARAJ M	B.TECH - MECHANICAL ENGINEERING
135	VTU24059	GURRALA NANDA KUMAR	B.TECH - MECHANICAL ENGINEERING
136	VTU24071	DINESHKUMAR G	B.TECH - MECHANICAL ENGINEERING
137	VTU24073	BORIGORLA AMARA NARASIMHA RAO	B.TECH - MECHANICAL ENGINEERING
138	VTU24074	NARAGA BRAHMAJI	B.TECH - MECHANICAL ENGINEERING
139	VTU24082	GOKUL M	B.TECH - MECHANICAL ENGINEERING
140	VTU24085	SHAIK MAHAMMAD IMRAN	B.TECH - MECHANICAL ENGINEERING
141	VTU24089	IMMIDI D N V V SATYANARAYANA	B.TECH - MECHANICAL ENGINEERING
142	VTU24099	GARAPATI SANJEEVI KUMAR	B.TECH - MECHANICAL ENGINEERING

143	VTU24101	YEKNATH M	B.TECH - MECHANICAL ENGINEERING
144	VTU23977	KURRA NAGENDRA	B.TECH - MECHANICAL ENGINEERING with specialization in Artificial Intelligence and Robotics
145	VTU23979	YAMPALAKU SURYA PRASAD	B.TECH - MECHANICAL ENGINEERING with specialization in Artificial Intelligence and Robotics
146	VTU24012	BANDI SAHITHI	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
147	VTU24023	MOHAMED SULTHAN	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
148	VTU24025	KAIRAMEKALA MANI BHARATH	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
149	VTU24033	MOHAMED ASLAM S	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
150	VTU24060	PONNAPUDI DURGA PRASAD	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
151	VTU24061	VETTI REVANTH	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
152	VTU24068	FARAJ HUQ A	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
153	VTU24078	KARE HARSHAVARDHAN	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
154	VTU24086	PEDDANABOINA GOVARDHAN	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND ROBOTICS
155	VTU23986	KONATHALA THANAY GANESH KUMAR	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN AUTOMATION AND ROBOTICS
156	VTU23987	KARRIMAJJI PRAVEEN KUMAR	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN AUTOMOBILE ENGINEERING
157	VTU23953	J VIDHYA LAKSHMI	B.TECH - MECHANICAL ENGINEERING WITH SPECIALIZATION IN MECHATRONICS



MIGRATION APPLIED STUDENTS NAME LIST

A) Migration of Specialization

S.No	VTU NO	Name	Present Programme	Migration Applied To
1	21477	SMRITI GHIMIRE	Biomedical	Biomedical - AI in Healthcare
2	19829	P.PALLAVI	Biomedical	Biomedical - AI in Healthcare
3	20898	AKRITI VISHWAKARMA	Biomedical	Biomedical - AI in Healthcare
4	21008	SHANISH MOHAMMED	Biomedical	Biomedical - AI in Healthcare
5	19021	K.SREENIDHI	Biomedical	Biomedical - AI in Healthcare
6	20814	ALBY. M. BIJU	Biomedical	Biomedical - AI in Healthcare
7	20916	ABIHIJITH AJIKUMAR	Biomedical	Biomedical - AI in Healthcare
8	20882	ABILASH BABU	Biomedical	Biomedical - AI in Healthcare
9	20609	STANIL FRANCIS	Biomedical	Biomedical - AI in Healthcare
10	19725	TANSIHQ OJHA	Biomedical	Biomedical - AI in Healthcare
11	21280	K INDHU	Biomedical	Biomedical - AI in Healthcare
12	21278	K. DIVYA	Biomedical	Biomedical - AI in Healthcare
13	21281	M.CHANDRA SAILAJA	Biomedical	Biomedical - AI in Healthcare
14	18966	PINNAMARAJU SAI POOJITHA	CSE- AI&ML	Computer Science & Engineering
15	19246	RONANKI DASARADH	CSE- AI&ML	Computer Science & Engineering

16	20038	KOMMI PRAVALLIKA	CSE- AI&ML	CSE - AI&DS
17	20028	CHILLAKURU SHAINI	Computer Science & Engineering	CSE - AI&DS
18	20061	THUTA NARASIMHA SAGAR	Computer Science & Engineering	CSE - AI&DS
19	19100	VATTIKUNTLA ANUSHA	Computer Science & Engineering	CSE - AI&ML
20	19852	MARKAPURAM VENKATA PRASANNA KUMAR	Computer Science & Engineering	CSE - AI&ML
21	19750	POTHURI CHAITANYA	Computer Science & Engineering	CSE - AI&ML
22	20114	CHITTE YELLA KRISHNA REDDY	Computer Science & Engineering	CSE - AI&ML
23	20092	S KRISHNA CHAITANYA REDDY	Computer Science & Engineering	CSE - AI&ML
24	20607	PENMETS SA SANJANA	Computer Science & Engineering	CSE - AI&ML
25	19819	SURABHI SAI VASUDHA	Computer Science & Engineering	CSE - AI&ML
26	19703	NANDI VENKATESWARULU REDDY	Computer Science & Engineering	CSE - AI&ML
27	19012	VASANTH S	Computer Science & Engineering	CSE - AI&ML
28	19481	KODAMANCHILI N S S KRISHNA ADITYA	Computer Science & Engineering	CSE - AI&ML
29	20113	CHITTE YELLANAGI REDDY	Computer Science & Engineering	CSE - AI&ML
30	19060	GEDDADA BHAVANA PUSHPA PRIYA	CSE- Cyber Security	CSE - AI&ML
31	19589	M JAYAVARDHAN	Computer Science & Engineering	CSE - AI&ML
32	20087	GUDURU SUNDEEP REDDY	Computer Science & Engineering	CSE - AI&ML
33	19638	P VENU	Computer Science & Engineering	CSE - AI&ML
34	19714	JIDUGU SRI NAGA AKHIL	Computer Science & Engineering	CSE- Cyber Security

35	19752	THIRUNALVELI SUSMITHA	Computer Science & Engineering	CSE- Cyber Security
36	20571	THOTA KARUNAKAR	Computer Science & Engineering	CSE - Data Science
37	20427	SUNDARANEEDI CHANDRA VENKATA SUBHASHINI	Computer Science & Engineering	CSE - Data Science
38	19850	UPPALAPATI RAMYA SRI	Computer Science & Engineering	CSE - Data Science
39	20496	LENKA DURGA PRASAD	Computer Science & Engineering	CSE - Data Science
40	20494	KUTCHARLAPATI VISHNU VARDHAN VARMA	Computer Science & Engineering	CSE - Data Science
41	19761	GUNTUPALLI OM SRAVYA	CSE- Cyber Security	CSE - Data Science
42	19393	BHAVANAM SAI AKSHITHA	Computer Science & Engineering	CSE - Data Science
43	20677	I.JAHNAVI	Electronics and Communication Engineering	ECE-AI&DS
44	19657	E.SAI KOTESWARA RAO	Information Technology	Information Technology (CC)
45	20790	D PRANEETH KUMAR	Mechanical - Artificial Intelligence & Robotics	Mechanical Engineering

B) Migration Programme

S.No	VTU NO	Name	Present Programme	Migration Applied To
1	21175	D JAHNAVI	Electronics and Communication Engineering	Aeronautical Engineering
2	21231	B. AJAY KUMAR	Electronics and Communication Engineering	Biomedical Engineering
3	21040	NELLORE BALAJISAI REDDY	Electronics and Communication Engineering	Computer Science & Engineering
4	20697	KALLE BHAVYA SREE	Computer Science and Design	Computer Science & Engineering
5	21197	CH. NAVEEN REDDY	Electronics and Communication Engineering	Electrical and Electronics Engineering
6	21310	NIDIGANTI LAKSHMI PRASANNA	Biotechnology	Electronics and Communication Engineering
7	19630	KODIGUDLA MAHESH	Electrical and Electronics Engineering	Electronics and Communication Engineering
8	20118	SHAIK ESWAR MANOJ	Electrical and Electronics Engineering	Electronics and Communication Engineering
9	19751	K. REVANTHKUMAR	Electrical and Electronics Engineering	Electronics and Communication Engineering
10	21327	ETHAMUKKALA GAYATHRI	Biotechnology	Electronics and Communication Engineering
11	19985	ASMA THABASUM	Biomedical Engineering	Electronics and Communication Engineering
12	21321	MARAM GOPI KRISHNA	Electrical and Electronics Engineering	Electronics and Communication Engineering
13	21322	KUNCHALA NARAYANA RAO	Electrical and Electronics Engineering	Electronics and Communication Engineering

14	18975	S SANTHOSH	Computer Science & Engineering	Electronics and Communication Engineering
15	19895	K CHANDRA SEKHAR	Civil Engineering	Mechanical Engineering
16	19766	STALIN REDDY	Civil Engineering	Mechanical Engineering



Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology					
STUDENT INTAKE FOR THE ACADEMIC YEAR 2022-23 AS ON 06.10.2022					
S.No.	Programme	Approved Intake as per AICTE	Supernumerary Seats (15% Additional to Intake)	Total Approved Intake	Admitted Count
UNDER GRADUATE - ENGINEERING PROGRAMMES					
1	AERONAUTICAL ENGINEERING	60	9	69	21
2	ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE	60	9	69	69
3	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	60	9	69	69
4	BIOMEDICAL ENGINEERING	60	9	69	67
5	BIOTECHNOLOGY	60	9	69	69
6	CIVIL ENGINEERING	60	9	69	11
8	COMPUTER SCIENCE AND ENGINEERING	1104	166	1270	1267
7	COMPUTER SCIENCE AND DESIGN	60	9	69	69
9	COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)	60	0	60	60
10	COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)	60	0	60	59
11	COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)	60	0	60	60
12	ELECTRICAL AND ELECTRONICS ENGINEERING	60	9	69	35
13	ELECTRONICS & COMMUNICATION ENGINEERING	480	72	552	552
14	INFORMATION TECHNOLOGY	60	9	69	69
15	MECHANICAL ENGINEERING	60	9	69	20
Total		2364	328	2692	2497



POST GRADUATE - PROGRAMMES					
1	AERONAUTICAL ENGINEERING (UNMANNED AERIAL VEHICLE)	18	0	18	2
2	BIG DATA ANALYTICS	18	0	18	4
3	BIOTECHNOLOGY	18	0	18	2
4	COMPUTER SCIENCE AND ENGINEERING	18	0	18	3
5	EMBEDDED SYSTEMS AND TECHNOLOGIES	18	0	18	9
6	ENVIRONMENTAL ENGINEERING	18	0	18	5
7	INDUSTRIAL SAFETY AND ENGINEERING	18	3	21	21
8	INFORMATION AND CYBER SECURITY	18	0	18	2
9	METALLURGICAL AND MATERIAL SCIENCE ENGINEERING	18	0	18	10
10	NETWORK ENGINEERING	18	0	18	0
11	POWER ELECTRONICS	18	0	18	7
12	STRUCTURAL ENGINEERING	18	0	18	4
13	MASTER OF BUSINESS ADMINISTRATION	120	18	138	137
Total		336	21	357	206



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UNDER GRADUATE & POST GRADUATE - ARTS & SCIENCE PROGRAMMES			
S.No.	Programme	Approved Intake	Admitted Count
1	B.COM	240	211
2	B.B.A	60	58
3	B.SC VISUAL COMMUNICATION	30	23
4	B.SC MULTIMEDIA	30	16
5	B.A. L.L.B (Hons.)	120	120
6	B.Com. L.L.B (Hons.)	120	120
7	M.A., English	30	1
8	M.Sc., Mathematics	30	7
9	M.Sc., Physics	30	18
10	M.Sc., Chemistry	30	29
11	M.Sc., Data Analytics	30	17
Total		750	620



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OFFICE OF CONTROLLER OF EXAMINATIONS

RESULT ANALYSIS APR / MAY – 2022 EXAMINATIONS

ACADEMIC YEAR 2021 - 22

RESULT ANALYSIS APR / MAY – 2022 EXAMINATIONS

B.TECH. - TOTAL NUMBER OF COURSES FOR WHICH THE EXAMS ARE CONDUCTED

Course	Aero	Auto	Civil	Mech	EEE	ECE	CSE	IT	Bio-Tech	Bio-Med
Foundation	27									
Programme Core	13	10	19	40	14	24	80	17	13	10
Programme Elective	10	8	9	26	3	39	35	7	4	5
Allied Elective	5	4	7	6	10	9	15	9	5	2
Institute Elective	24	23	29	35	28	42	71	29	15	10
Total	52	45	64	107	55	114	201	62	37	27
Grand Total	791									

B.TECH. PROGRAMMES				
Department	Semester	Student Count	All Clear Count	%
Aeronautical	2 nd	32	19	59.38
	4 th	46	32	69.57
	6 th	77	59	76.62
	8 th	85	80	94.12
Automobile	4 th	11	5	45.45
	6 th	52	47	90.38
	8 th	26	25	96.15
Bio-Medical	2 nd	22	12	54.54
	4 th	21	18	85.71
	6 th	9	9	100
	8 th	32	32	100
Bio-Tech	2 nd	52	41	78.85
	4 th	38	33	86.84
	6 th	26	22	84.62
	8 th	14	14	100
CIVIL	2 nd	32	19	59.37
	4 th	63	35	55.56
	6 th	86	60	69.77
	8 th	70	61	87.14
AI&ML	2 nd	69	55	79.71
AI&DS	2 nd	69	58	84.06
CS&D	2 nd	69	47	68.12
CSE	2 nd	1096	863	78.74
	4 th	1032	831	80.52
	6 th	1123	1001	89.14

	8 th	895	870	97.21
ECE	2 nd	647	476	73.57
	4 th	370	224	60.54
	6 th	681	587	86.2
	8 th	486	464	95.47
EEE	2 nd	22	16	72.73
	4 th	38	19	50
	6 th	63	42	66.67
	8 th	47	45	95.74
IT	2 nd	68	50	73.53
	4 th	48	41	85.42
	6 th	62	53	85.48
	8 th	53	49	92.45
MECHANICAL	2 nd	51	28	54.90
	4 th	82	54	65.85
	6 th	238	182	76.47
	8 th	243	230	94.65

LAW PROGRAMMES				
Department	Semester	Student Count	All Clear Count	%
B.A LL.B.(Hons)	2 nd	117	97	82.91
	4 th	71	56	78.87
	6 th	45	41	91.11
	8 th	24	23	95.83
B.Com LL.B.(Hons)	2 nd	91	83	91.21
	4 th	56	49	87.5
	6 th	31	30	96.77
	8 th	4	4	100
ARTS AND SCIENCE PROGRAMMES				
B.Com (Corporate Secretaryship)	2 nd	15	11	73.33
	4 th	14	13	92.86
	6 th	4	3	75
B.Com (General)	2 nd	72	55	76.39
	4 th	76	57	75
	6 th	51	46	90.2
B.Com (Accounting and Finance)	2 nd	22	19	86.36
	4 th	23	20	86.96
	6 th	4	4	100
BBA	2 nd	27	25	92.59
	4 th	23	21	91.3
	6 th	31	31	100
B.Sc (Multimedia)	2 nd	9	7	77.77
	4 th	6	4	66.66
	6 th	18	17	94.44
B.Sc (Visual Communication)	2 nd	14	12	85.71
	4 th	15	9	60
	6 th	15	9	60

M.TECH. DEGREE PROGRAMMES				
Department	Semester	Student Count	All Clear Count	%
M.Tech. (Aeronautical Engineering)	2 nd	6	5	83.33
	4 th	3	3	100
M.Tech. (Big Data Analytics)	2 nd	8	7	87.5
	4 th	1	1	100
M.Tech. (Automobile Engineering)	4 th	14	14	100
M.Tech. (CAD/CAM)	4 th	7	7	100
M.Tech. (Structural Engineering)	2 nd	6	6	100
	4 th	3	3	100
M.Tech. (Power Electronics)	2 nd	6	3	50
	4 th	12	10	83.33
M.Tech. (Network Engineering)	2 nd	1	1	100
	4 th	2	2	100
M.Tech. (Metallurgy)	2 nd	10	8	80
	4 th	9	8	88.89
M.Tech. (Machine Design)	4 th	1	1	100
M.Tech. (Information and Cyber Security)	2 nd	6	6	100
	4 th	5	5	100
M.Tech. (Industrial Safety Engineering)	2 nd	17	17	100
	4 th	14	14	100
M.Tech. (Industrial Engineering)	4 th	5	5	100
M.Tech. (Geotechnical Engineering)	4 th	5	5	100
M.Tech. (Environmental Engineering)	2 nd	5	5	100
	4 th	5	5	100
M.Tech. (Embedded Systems)	2 nd	7	7	100
	4 th	4	4	100
M.Tech. (CSE)	2 nd	7	6	85.71
	4 th	4	4	100
M.Tech. (Construction Engineering and Management)	4 th	2	2	100
M.Tech. (Biotechnology)	2 nd	12	11	91.67
	4 th	3	3	100
M.Sc. DEGREE PROGRAMMES				
M.Sc (Chemistry)	2 nd	30	23	76.67
	4 th	28	28	100
M.Sc (Physics)	2 nd	22	21	95.45
	4 th	14	14	100
M.Sc (Data Analytics)	2 nd	12	8	66.67
	4 th	1	1	100
M.Sc (Maths)	2 nd	8	6	75
	4 th	13	12	92.31
M.B.A. DEGREE PROGRAMMES				
MBA	2 nd	88	83	94.32
	4 th	68	66	97.06

M.A. DEGREE PROGRAMMES

M.A (English)	2 nd	13	8	61.54
	4 th	8	8	100



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ACADEMIC CALENDAR

AY 2022-23

Programmes

ENGINEERING	1
1.1 Under Graduate (UG)	1
1.1.1 B.Tech. - First Year	1
1.1.2 B.Tech. - Second Year	2
1.1.3 B.Tech. - Third and Final Year	3
1.2 Post Graduate	4
1.2.1 M.Tech. - First Year	4
1.2.2 M.Tech. - Higher Semesters	5
LAW Programmes	6
1.3 Under Graduate (UG)	6
1.3.1 B.A.LL.B./B.Com.,LL.B. - First Year	6
1.3.2 B.A.LL.B./B.Com.,LL.B. - Second Year	7
1.3.3 B.A.LL.B./B.Com.,LL.B. - Higher Semesters	8
Arts and Science Programmes	9
1.4 Under Graduate (UG)	9
1.4.1 B.Sc., - First Year	9
1.4.2 B.Sc., - II YEAR	10
1.4.3 B.Sc., - III YEAR	11
1.4.4 B.Com./B.B.A., - First Year	12
1.4.5 B.Com. - II YEAR	13
1.4.6 B.B.A. - II YEAR	14
1.4.7 B.Com./ B.B.A - III YEAR	15
1.5 Post Graduate (PG)	16
1.5.1 M.A/M.Sc., - First Year	16

1.5.2 M.A/M.Sc., - Higher Semesters	17
Management	18
1.6 Post Graduate (PG)	18
1.6.1 M.B.A., First Year	18
1.6.2 M.B.A., Higher Semesters	19
1.6.3 M.B.A - IEV , Higher Semesters	20
Holidays	21
1.7 Public Holiday - Notification	21

1.1 Under Graduate (UG)

1.1.1 B.Tech. - First Year

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-23		
B.Tech. – First Year	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of IcA Programme	24-Aug-22	Not Applicable
IcA Holidays	10-Sep-22 to 14-Sep-22	Not Applicable
Commencement of Student Semester Registration	Not Applicable	30-Jan-23
Commencement of Class Work	15-Sep-22	06-Feb-23
Last Date for Semester Registration	Not Applicable	13-Feb-23
Last Date for Semester Registration with late fee / Course Registration	Not Applicable	20-Feb-23
Test - 1 (Theory Courses)	13-Oct-22	01-Mar-23
Mid Term Test - 1 (Integrated Courses)	01-Nov-22	20-Mar-23
Test -2 (Theory Courses)	25-Nov-22	10-Apr-23
Model-Practical Exam	19-Dec-22	08-May-23
Test-3 (Theory Courses) / Mid Term Test - 2 (Integrated Courses)	26-Dec-22	17-May-23
Last Instructional Day	04-Jan-23	27-May-23
EXAMINATIONS		
Semester End Exam Timetable notification	12-Dec-22	02-May-23
Commencement of Semester End Practical Examination	09-Jan-23	31-May-23
Commencement of Semester End Theory Examination	17-Jan-23	05-Jun-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	One week from the date of Last Examination
HOLIDAYS		
LIST OF PUBLIC HOLIDAYS	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA HOLIDAYS	01-Oct-22 to 05-Oct-22	
Commencement of the Next Academic Year (2023-24) is 26-JULY-2023 (Tentatively)		

*First and Third Saturday – Non Instructional day



Dr. M. J. Carmel Mary Belinda
Dean - Academics
in-charge



Dr. M. Sivalumar
Dean - Freshmen Engineering



Prof. S. Sathya
Vice-Chancellor

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Ref No: LT/19/2023

1.1.2 B.Tech. - Second Year

19-05-2022

Date:

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-23		
B.Tech. – II YEAR	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	28-Jun-22	15-Dec-22
Commencement of Course Registration	18-Jul-22	26-Dec-22
Commencement of Class Work	25-Jul-22	02-Jan-23
Last Date for Semester Registration	01-Aug-22	09-Jan-23
Last Date for Semester Registration with late fee / Course Registration	08-Aug-22	19-Jan-23
Test - 1 (Theory Courses)	22-Aug-22	31-Jan-23
Mid Term Test - I (Integrated Courses)	19-Sep-22	25-Feb-23
Test -2 (Theory Courses)	17-Oct-22	24-Mar-23
Model-Practical Exam	02-Nov-22	11-Apr-23
Test-3 (Theory Courses) / Mid Term Test - 2 (Integrated Courses)	07-Nov-22	17-Apr-23
Last Instructional Day	12-Nov-22	25-Apr-23
EXAMINATIONS		
Semester End Exam Timetable notification	31-Oct-22	04-Apr-23
Commencement of Semester End Practical/Viva-voce Examination	14-Nov-22	27-Apr-23
Commencement of Semester End Theory Examination	24-Nov-22	10-May-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	One week from the date of Last Examination
HOLIDAYS		
LIST OF PUBLIC HOLIDAYS	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA HOLIDAYS	01-Oct-22 to 05-Oct-22	
INPLANT TRAINING	18 – Jul-22 to 25 – Jul-22	15-Dec-22 to 31-Dec-22
Commencement of the Next Academic Year (2023-24) is 26-JUNE-2023 (Tentatively)		

*First and Third Saturday – Non Instructional day



C.M. Belinda
 Dr. M. J. Carmel Mary Belinda
 Dean - Academics
 In-charge

Vel Tech
 Rangarajan Dr. Sagunthala
 R&D Institute of Science and Technology

S. Selina
 Prof. S. Selivanan
 Vice Chancellor

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Prof. M. J. Carmel Mary Belinda

1.1.3 B.Tech. - Third and Final Year

19-05-2022

Date:

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-23		
B.Tech. – III and IV YEAR	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	28-Jun-22	15-Dec-22
Commencement of Course Registration	18-Jul-22	26-Dec-22
Commencement of Class Work	25-Jul-22	02-Jan-23
Last Date for Semester Registration	01-Aug-22	09-Jan-23
Last Date for Semester Registration with late fee / Course Registration	08-Aug-22	19-Jan-23
Unit Test-1 / Project Review-1	* 22-Aug-22	31-Jan-23
Mid Term Test-1	19-Sep-22	25-Feb-23
Unit Test – 2 / Project Review – 2	17-Oct-22	24-Mar-23
Model Practical Exam	02-Nov-22	11-Apr-23
Mid Term Test – 2	07-Nov-22	17-Apr-23
Last Instructional Day	12-Nov-22	25-Apr-23
EXAMINATIONS		
Semester End Exam Timetable notification	31-Oct-22	04-Apr-23
Commencement of Semester End Practical/Viva-voce Examination	14-Nov-22	27-Apr-23
Commencement of Semester End Theory Examination	24-Nov-22	10-May-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	One week from the date of Last Examination
HOLIDAYS		
LIST OF PUBLIC HOLIDAYS	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA HOLIDAYS	01-Oct-22 to 05-Oct-22	
INPLANT TRAINING	18 – Jul-22 to 25 – Jul-22	15-Dec-22 to 31-Dec-22
Commencement of the Next Academic Year (2023-24) is 26-JUNE-2023 (Tentatively)		

*First and Third Saturday – Non Instructional day




 Dr. M.J. Carmel Mary Belinda
 Dean - Academics
 in-charge


 Prof. S. Salivahanan
 Vice-Chancellor


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1.2 Post Graduate

1.2.1 M.Tech. - First Year

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022 - 2023		
M.TECH - First Year	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Student Semester Registration	-	02-Feb-23
Commencement of Course Registration	-	06-Feb-23
Commencement of Class Work	15-Sep-22	09-Feb-23
Last date for Semester Registration	-	16-Feb-23
Last date for Semester Registration with fine / last date for Course Registration	-	23-Feb-23
Mid Term Test - 1	02-Nov-22	27-Mar-23
Mid Term Test - 2	23-Dec-22	23-May-23
Model-Practical Exam	02-Jan-23	30-May-23
Last Instructional Day	04-Jan-23	05-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	05-Dec-22	03-May-23
Semester End Practical Exam	06-Jan-23	07-Jun-23
Semester End Theory Exam	23-Jan-23	30-Jun-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	
HOLIDAYS		
List of public holidays	As per Tamil Nadu Government Holidays	
Dussehra holidays	01-Oct-22 to 05-Oct-22	
Commencement of Next Academic Year (2023-24) – 26-JULY-2023 (Tentatively)		

First and Third Saturday – Non Instructional day



Vel Tech
Rangarajan Dr. Sagunthala

S. Salim
Prof. S. Salivahanan
Vice-Chancellor

Dr. S. Salivahanan
Dean, School of Mechanical and
Construction Engineering

Dr. S. Salivahanan
Rangarajan Dr. Sagunthala
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1.2.2 M.Tech. - Higher Semesters

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
M.Tech.\M.A.\M.Sc. - Higher Semesters	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Student Semester Registration	18-Jul-22	26-Dec-22
Commencement of Course Registration	25-Jul-22	02-Jan-22
Commencement of Class Work	01-Aug-22	09-Jan-23
Last Date for Semester Registration	08-Aug-22	19-Jan-23
Last Date for Semester Registration with late fee / Course Registration	* 16-Aug-22	24-Jan-23
Unit Test-1 / Project Review-1	29-Aug-22	07-Feb-23
Mid Term Test-1	26-Sep-22	06-Mar-23
Unit Test – 2 / Project Review – 2	26-Oct-22	31-Mar-23
Model Practical Exam	14-Nov-22	18-Apr-23
Mid Term Test – 2	18-Nov-22	28-Apr-23
Last Instructional Day	25-Nov-22	05-May-23
EXAMINATIONS		
Semester End Exam Timetable notification	31-Oct-22	10-Apr-23
Commencement of Semester End Practical/Viva-voce Examination	28-Nov-22	08-May-23
Commencement of Semester End Theory Examination	12-Dec-22	23-May-23
Declaration of Semester End Examination Results	One Week from the date of Last Examination	One Week from the date of Last Examination
HOLIDAYS		
List Of Public Holidays	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	

*First and Third Saturday – Non Instructional day



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Prof. P. N. L. 18/06/22

1.3 Under Graduate (UG)

1.3.1 B.A.LL.B./B.Com.,LL.B. - First Year

The following is the Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR (AY 2022 - 2023)		
UG (LAW Programme) – First Year	SUMMER SEMESTER	WINTER SEMESTER
Commencement of ICA Program	24-Aug-22	-
Commencement of Student Semester and Course Registration	-	02-Feb-23
Commencement of Class Work	01-Sep-22	09-Feb-23
Last date for Semester Registration	-	16-Feb-23
Last date for Semester Registration with late fee / Course Registration	-	23-Feb-23
Unit Test	26-Oct-22	27-Mar-23
Mid Term Test	15-Nov-22	17-May-23
Project Work presentation Starting date	15-Dec-22	29-May-23
Last Instructional Day	22-Dec-22	02-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	05-Dec-22	03-May-23
Semester End Theory Examination	23-Jan-23	30-Jun-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	
HOLIDAYS		
LIST OF PUBLIC HOLIDAYS	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA HOLIDAYS	01-Oct-22 to 05-Oct-22	
Commencement of the Next Academic Year (2023-24) is 26-JULY-2023 (Tentatively)		

S. Salivar

First and Third Saturday – Non Instructional day



C.M. Bal
 Dr. M. J. C. Mary Belinda
 Dean - Academics
 in-charge

Vel Tech
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ASRAMAN
 Dean, SOI

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Ref no: 11/1/2000

1.3.2 B.A.LL.B./B.Com.,LL.B. - Second Year

The following is the Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
B.A., LL.B./ B.Com., LL.B. – II Year	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	28-Jun-22	15-Dec-22
Commencement of Course Registration	18-Jul-22	26-Dec-22
Commencement of Class Work	25-Jul-22	02-Jan-23
Last Date for Semester Registration	*01-Aug-22	09-Jan-23
Last Date for Semester Registration with Late Fee	08-Aug-22	19-Jan-23
Unit-Test	12-Sep-22	20-Feb-23
Mid-Test	10-Oct-22	20-Mar-23
Project Work Presentations Starting date	26-Oct-22	10-Apr-23
Last Instructional Day	12-Nov-22	25-Apr-23
EXAMINATIONS		
Semester End Exam Time Table Notification	10-Oct-22	04-Apr-23
Commencement of Semester End Theory Examination	24-Nov-22	10-May-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
Commencement of the Next Academic Year (2023-24) is 05-JUN-2023 (Tentatively)		

First and Third Saturday – Non Instructional day

S. Sathish
Prof. S. Sathivanan
 Vice Chancellor

C.M. Belinda
 18/10/22
Dr. M. J. Carmel Mary Belinda
 Dean - Academics
 in-charge

(OK)
 SCHOOL OF LAW

Vel Tech

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for
M. Dhannagar
 14/10/22
(M. DHANAGAR)
 TTS 2789

Ref no: LT/15000

1.3.3 B.A.LL.B./B.Com.,LL.B. - Higher Semesters

Date:

19-05-2022

The following is the Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
B.A., LL.B./ B.Com., LL.B. – Higher Semesters	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	23-Jun-22	28-Nov-22
Commencement of Course Registration	27-Jun-22	05-Dec-22
Commencement of Class Work	04-Jul-22	12-Dec-22
Last Date for Semester Registration	11-Jul-22	19-Dec-22
Last Date for Semester Registration with Late Fee	18-Jul-22	26-Dec-22
Unit-Test	22-Aug-22	30-Jan-23
Mid-Test	26-Sep-22	13-Mar-23
Project Work Presentations Starting date	10-Oct-22	29-Mar-23
Last Instructional Day	26-Oct-22	18-Apr-23
EXAMINATIONS		
Semester End Exam Time Table Notification	10-Oct-22	20-Mar-23
Commencement of Semester End Theory Examination	11-Nov-22	03-May-23
Dedclaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
Commencement of the Next Academic Year (2023-24) is 05-JUN-2023 (Tentatively)		

First and Third Saturday – Non Instructional day

Dr. M. J. Carmel Mary Bellamy
Prof. A. Subramanyam
Prof. S. Selvam
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

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Ref:vtu.L1/T/2020

1.4 Under Graduate (UG)

1.4.1 B.Sc., - First Year

The following is the Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR (AY 2022-2023)		
B.Sc. – First Year	SUMMER SEMESTER	WINTER SEMESTER
Commencement of IcA Program	24-Aug-22	-
Commencement of Student Semester Registration	-	02-Feb-23
Commencement of Class Work	01-Sep-22	09-Feb-23
Last Date For Semester Registration	-	16-Feb-23
Last Date For Semester Registration With Fine	-	23-Feb-23
Test - 1	11-Oct-22	15-Mar-23
Test - 2	16-Nov-22	27-Apr-23
Test - 3	21-Dec-22	01-Jun-23
Last Instructional Day	03-Jan-23	14-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	05-Dec-22	15-May-23
Semester End Practical Exam	05-Jan-23	16-Jun-23
Semester End Theory Exam	23-Jan-23	30-Jun-23
Declaration Of Semester End Examination Results	One week from the date of Last Examination	
HOLIDAYS		
LIST OF PUBLIC HOLIDAYS	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA HOLIDAYS	01-Oct-22 to 05-Oct-22	
Commencement of Next Academic Year (2023-24) – 26-JULY-2023 (Tentatively)		

All Saturday – Non Instructional day

cm/bed
23/02/23

S. Selvaraj
Prof. S. Selvaraj
Vice Chancellor

Dr. E. Suresh Paul
Dean School of Media Technology
and Communication
Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Chennai-600 062, Tamil Nadu, India

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Ref No: 11/20200

1.4.2 B.Sc., - II YEAR

Date:
19-05-2022

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
B.Sc. – II YEAR	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	23-Jun-22	12-Dec-22
Commencement of Course Registration	27-Jun-22	19-Dec-22
Commencement of Class Work	04-Jul-22	26-Dec-22
Last date for Semester Registration	11-Jul-22	02-Jan-23
Last date for Semester Registration with Late fee / Course Registration	* 18-Jul-22	09-Jan-23
Test - 1	08-Aug-22	02-Feb-23
Test - 2	26-Sep-22	09-Mar-23
Model Practical Examination	27-Oct-22	11-Apr-23
Test - 3	01-Nov-22	18-Apr-23
Last Instructional Day	08-Nov-22	03-May-23
EXAMINATIONS		
Semester End Exam Time Table Notification	10-Oct-22	03-Apr-23
Commencement of Semester End Practical/Project Examination	09-Nov-22	04-May-23
Commencement of Semester End Theory Examination	24-Nov-22	22-May-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
In-Plant Training	NIL	12-Dec-22 to 24-Dec-22
Commencement of the Next Academic Year (2023-24) is 26-JUNE-23 (Tentatively)		

* All Saturday – Non Instructional day



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Ref No: 11/1/2022

1.4.3 B.Sc., - III YEAR

Date: 18-05-2022

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
B.Sc. – III YEAR	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Student Semester Registration	25-May-22	21-Nov-22
Commencement of Course Registration	01-Jun-22	28-Nov-22
Commencement of Class Work	08-Jun-22	05-Dec-22
Last date for Semester Registration	15-Jun-22	12-Dec-22
Last date for Semester Registration with Late fee / Course Registration	22-Jun-22	19-Dec-22
Unit Test I	06-Jul-22	02-Jan-23
Mid Term Test I	03-Aug-22	03-Feb-23
Unit Test II	06-Sep-22	02-Mar-23
Model-Practical Exam	26-Sep-22	23-Mar-23
Mid Term Test II	06-Oct-22	30-Mar-23
Last Instructional Day	12-Oct-22	10-Apr-23
EXAMINATIONS		
Semester End Exam Time Table Notification	03-Sep-22	13-Mar-23
Commencement of Semester End Practical/ Project Viva-voce Examination	14-Oct-22	12-Apr-23
Commencement of Semester End Theory Examination	28-Oct-22	26-Apr-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
In-Plant Training	25-May-22 to 07-Jun-22	21-Nov-22 to 04-Dec-22

* All Saturday – Non instructional day

Dr. E. Suresh Paul
Dean-School of Media Technology and Communication

S.P. Subramanian
Vice Chancellor

Dr. Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology

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Ref:vtu/11/10000

1.4.4 B.Com./B.B.A., - First Year

The following is the Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR (2022-2023)		
B.B.A/B.Com. – First Year	SUMMER SEMESTER	WINTER SEMESTER
Commencement of icA Program	24-Aug-22	-
Commencement Of Student Semester and Course Registration	-	02-Feb-23
Commencement Of Class Work	05-Sep-22	09-Feb-23
Last Date For Semester Registration	-	16-Feb-23
Last Date For Semester Registration With Fine	-	23-Feb-23
Test - 1	13-Oct-22	15-Mar-23
Test - 2	21-Nov-22	26-Apr-23
Test - 3	23-Dec-22	30-May-23
Last Instructional Day	05-Jan-23	14-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	07-Dec-22	15-May-23
Semester End Theory Exam	23-Jan-23	30-Jun-23
Declaration Of Semester End Examination Results	One week from the date of Last Examination	
HOLIDAYS		
LIST OF PUBLIC HOLIDAYS	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA HOLIDAYS	01-Oct-22 to 05-Oct-22	
Commencement of Next Academic Year (2023-24) – 26-JULY-2023 (Tentatively)		

All Saturday – Non Instructional day

S. Salwan
 Prof. S. Salivahanan
 Vice Chancellor

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C.M. Bel
 23/8/22
MURM
 23/8/22
J.L.
 23/8/22

1.4.5 B.Com. - II YEAR

Date: 05-2022

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
B.Com – II YEAR	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	23-Jun-22	12-Dec-22
Commencement of Course Registration	27-Jun-22	19-Dec-22
Commencement of Class Work	04-Jul-22	26-Dec-22
Last date for Semester Registration	11-Jul-22	02-Jan-23
Last date for Semester Registration with Late fee / Course Registration	18-Jul-22	09-Jan-23
Test - 1	08-Aug-22	02-Feb-23
Test - 2	26-Sep-22	09-Mar-23
Model Practical Examination	27-Oct-22	11-Apr-23
Test - 3	01-Nov-22	18-Apr-23
Last Instructional Day	08-Nov-22	03-May-23
EXAMINATIONS		
Semester End Exam Time Table Notification	10-Oct-22	03-Apr-23
Commencement of Semester End Practical/Project Examination	09-Nov-22	04-May-23
Commencement of Semester End Theory Examination	24-Nov-22	22-May-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
In-Plant Training	NIL	12-Dec-22 to 24-Dec-22
Commencement of the Next Academic Year (2023-24) is 26-JUNE-23 (Tentatively)		

* All Saturday – Non Instructional day



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R&D Institute of Science and Technology
Approved by the Tamil Nadu State Council of Higher Education, 1988

C.M. Balinda
19/10/22

J. Lal
19/10/22

S. Sakin

Prof. S. Sathyanarayanan
Vice-Chancellor

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1.4.6 B.B.A. - II YEAR

Date: 2022

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
B.B.A – II YEAR	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	03-Aug-22	23-Jan-23
Commencement of Course Registration	10-Aug-22	30-Jan-23
Commencement of Class Work	17-Aug-22	06-Feb-23
Last date for Semester Registration	24-Aug-22	13-Feb-23
Last date for Semester Registration with Late fee / Course Registration	30-Aug-22	20-Feb-23
Review - 1	02-Sep-22	-NA-
Test - 1	22-Sep-22	13-Mar-23
Review - 2	31-Oct-22	-NA-
Test - 2	03-Nov-22	24-Apr-23
Model Practical Examination	07-Dec-22	29-May-23
Test - 3	13-Dec-22	05-Jun-23
Last Instructional Day	21-Dec-22	12-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	21-Nov-22	15-May-23
Internship Viva-voce	22-Dec-22	13-Jun-23
Commencement of Semester End Theory Examination	05-Jan-23	28-Jun-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
Commencement of the Next Academic Year (2023-24) is 13-JULY-23 (Tentatively)		

* All Saturday – Non Instructional day

C.M. [Signature]
2/8/22

M. [Signature]
28/8/22

J.L. [Signature]
2/8/22

S. Salivan
Prof. S. Salivanhanan
Vice Chancellor

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Ref no: L1/15000

1.4.7 B.Com./ B.B.A - III YEAR

Date: 18-05-2022

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
2022-2023		
B.Com\B.B.A – III YEAR	SUMMER SEMESTER	WINTER SEMESTER (Tentatively)
Commencement of Student Semester Registration	25-May-22	21-Nov-22
Commencement of Course Registration	01-Jun-22	28-Nov-22
Commencement of Class Work	08-Jun-22	05-Dec-22
Last date for Semester Registration	15-Jun-22	12-Dec-22
Last date for Semester Registration with Late fee / Course Registration	22-Jun-22	19-Dec-22
Cycle Test I	20-Jul-22	19-Jan-23
Cycle Test II	06-Sep-22	01-Mar-23
Model-Practical Exam	26-Sep-22	23-Mar-23
Model Examination	06-Oct-22	30-Mar-23
Last Instructional Day	12-Oct-22	10-Apr-23
EXAMINATIONS		
Commencement of Semester End Exam Time Table Notification	03-Sep-22	13-Mar-23
Commencement of Semester End Practical/ Project Viva voce Examination	14-Oct-22	12-Apr-23
Commencement of Semester End Theory Examination	28-Oct-22	26-Apr-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	
In-Plant Training	25-May-22 to 07-Jun-22	21-Nov-22 to 04-Dec-22

* All Saturday – Non Instructional day



S. Salim

Prof. S. Salivahanan
Vice-Chancellor



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Vel Tech 11/18000

1.5 Post Graduate (PG)

1.5.1 M.A/M.Sc., - First Year

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022 - 2023		
M.Sc. / M.A. - First Year	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Student Semester Registration	-	02-Feb-23
Commencement of Course Registration	-	06-Feb-23
Commencement of Class Work	15-Sep-22	09-Feb-23
Last date for Semester Registration	-	16-Feb-23
Last date for Semester Registration with fine / last date for Course Registration	-	23-Feb-23
Mid Term Test - 1	02-Nov-22	27-Mar-23
Mid Term Test - 2	23-Dec-22	23-May-23
Model-Practical Exam	02-Jan-23	30-May-23
Last Instructional Day	04-Jan-23	05-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	05-Dec-22	03-May-23
Semester End Practical Exam	06-Jan-23	07-Jun-23
Semester End Theory Exam	23-Jan-23	30-Jun-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	
HOLIDAYS		
List of public holidays	As per Tamil Nadu Government Holidays	
Dussehra holidays	01-Oct-22 to 05-Oct-22	
Commencement of Next Academic Year (2023-24) – 26-JULY-2023 (Tentatively)		

First and Third Saturday – Non Instructional day



Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Commenced to Operate from 26th July 1995

S. Sahim
Prof. S. Subrahman
Vice Chancellor

Dr. M. Sivakumar
Dean - Freshman Engineering

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1.5.2 M.A/M.Sc., - Higher Semesters

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022-2023		
M.Tech.\M.A.\M.Sc. - Higher Semesters	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Student Semester Registration	18-Jul-22	26-Dec-22
Commencement of Course Registration	25-Jul-22	02-Jan-22
Commencement of Class Work	01-Aug-22	09-Jan-23
Last Date for Semester Registration	08-Aug-22	19-Jan-23
Last Date for Semester Registration with late fee / Course Registration	* 16-Aug-22	24-Jan-23
Unit Test-1 / Project Review-1	29-Aug-22	07-Feb-23
Mid Term Test-1	26-Sep-22	06-Mar-23
Unit Test – 2 / Project Review – 2	26-Oct-22	31-Mar-23
Model Practical Exam	14-Nov-22	18-Apr-23
Mid Term Test – 2	18-Nov-22	28-Apr-23
Last Instructional Day	25-Nov-22	05-May-23
EXAMINATIONS		
Semester End Exam Timetable notification	31-Oct-22	10-Apr-23
Commencement of Semester End Practical/Viva-voce Examination	28-Nov-22	08-May-23
Commencement of Semester End Theory Examination	12-Dec-22	23-May-23
Declaration of Semester End Examination Results	One Week from the date of Last Examination	One Week from the date of Last Examination
HOLIDAYS		
List Of Public Holidays	AS PER TAMIL NADU STATE GOVERNMENT PUBLIC HOLIDAYS	
DUSSEHRA Holidays	01-Oct-22 to 05-Oct-22	

*First and Third Saturday – Non Instructional day



Dr. M. J. Carmol Mary Belinda
Dean - Academics
in-charge

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology

C.M. Belinda
30/5/22

S. Selvam
Prof.S. Selvam
Vice Chancellor

Vel Tech
Rangarajan Dr. Sagunthala
R&D Institute of Science and Technology
Approved from Government, Regd. and Affiliated to VIT-VEL

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Website : www.veltech.edu.in

1.6 Post Graduate (PG)

1.6.1 M.B.A., First Year

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR		
AY 2022 - 2023		
M.B.A. - First Year	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Orientation Programme	16-Sep-22	
Commencement of Student Semester Registration	-	13-Feb-23
Commencement of Course Registration	-	16-Feb-23
Commencement of Class Work	26-Sep-22	20-Feb-23
Last date for Semester Registration	-	27-Feb-23
Last date for Semester Registration with fine / last date for Course Registration	-	06-Mar-23
Test - 1	31-Oct-22	23-Mar-23
Test - 2	01-Dec-22	28-Apr-23
Test - 3	02-Jan-23	30-May-23
Model-Practical Exam	11-Jan-23	08-May-23
Last Instructional Day	17-Jan-23	12-Jun-23
EXAMINATIONS		
Semester End Exam Time Table Notification	05-Dec-22	03-May-23
Semester End Practical Exam	23-Jan-23	13-Jun-23
Semester End Theory Exam	30-Jan-23	30-Jun-23
Declaration of Semester End Examination Results	One week from the date of Last Examination	
HOLIDAYS		
List of public holidays	As per Tamil Nadu Government Holidays	
Dussehra holidays	01-Oct-22 to 05-Oct-22	
Commencement of Next Academic Year (2023-2024) – 26-JULY-2023 (Tentatively)		

First and Third Saturday – Non Instructional day

S. Sathish

Prof. S. Sathivanan
Vice Chancellor

B. S. Sathivanan
10/9/22

Dr. M. J. Carmel Mary Belinda
Dean - Academics
in-charge

Vel Tech
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R&D Institute of Science and Technology

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1.6.2 M.B.A., Higher Semesters

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR 2022-2023		
M.B.A. - Higher Semester	SUMMER SEMESTER	WINTER SEMESTER
Commencement of Student Semester Registration	08-Aug-22	11-Jan-23
Commencement of Course Registration	16-Aug-22	23-Jan-23
Commencement of Class Work	22-Aug-22	30-Jan-23
Last date for Semester Registration	29-Aug-22	06-Feb-23
Last date for Semester Registration with Late fee / Course Registration	05-Sep-22	13-Feb-23
Mid Term Test - 1	10-Oct-22	15-Feb-23
Mid Term Test - 2	07-Nov-22	06-Mar-23
Mid Term Test - 3	01-Dec-22	23-Mar-23
Summer Internship/Project Review 1	21-Sep-22	10-Apr-23
Summer Internship / Project Review 2	31-Oct-22	10-May-23
Model Viva- voce / Last Instructional Day	12-Dec-22	25-May-23
EXAMINATION		
Semester End Exam Time Table Notification	10-Nov-22	17-Apr-23
University Viva -Voce Examination	16-Dec-22	29-May-23
Semester End Theory Examination	27-Dec-22	06-Jun-23
Declaration of Semester End Examination Results	Within one week from the date of last examination	Within one week from the date of last examination
HOLIDAYS		
List of Public Holidays	As per Tamil Nadu State Government Public Holidays	
Dussehra Holidays	01-Oct-22 to 05-Oct-22	

First and Third Saturday – Non Instructional day



Dr. M.J. Carmel Mary Bellinda
Dean - Academics
in-charge





S. Prabhakaran
Vice Chancellor



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Ref No: 33/ 10000

1.6.3 M.B.A - IEV , Higher Semesters

The Academic Calendar for the Academic Year 2022-23

ACADEMIC CALENDAR (2022- 2023)			
M.B.A. -IEV (Second Year)	SUMMER SEMESTER (Sem III) M-4	SUMMER SEMESTER (Sem III) M-5	WINTER SEMESTER (Sem IV) Action Learning Segment-2
Commencement of Student Semester Registration	16-Aug-22	-	24-Jan-23
Commencement of Course Registration	24-Aug-22	16-Nov-22	25-Jan-23
Orientation	29-Aug-22 to 02-Sep-22	-	-
Commencement of Class Work	05-Sep-22	21-Nov-22	30-Jan-23
Last Date for Semester Registration	31-Aug-22	-	06-Feb-23
Last date for Semester Registration with Late fee / Course Registration	05-Sep-22	-	06-Mar-23
Action Learning Segment -2	Review 1	-	17-Apr-23
	Review 2	-	24-Apr-23
	Review 3	-	22-May-23
Mid Term Test -1	22-Sep-22	08-Dec-22	-
Mid Term Test -2	10-Oct-22	19-Dec-22	-
Mid Term Test-3	31-Oct-22	06-Jan-23	-
Last Instructional Day	04-Nov-22	12-Jan-23	02-Jun-23
EXAMINATION			
Semester End Exam Time Table Notification	14-Oct-22	23-Dec-22	05-May-23
Semester End Practical Exam	-	-	05-June-23
Semester End Theory Exam	14-Nov-22	23-Jan-23	-
HOLIDAYS			
List of Public Holidays	As per Tamil Nadu Government Holidays		
Dussehra Holidays	01-Oct-22 to 05-Oct-22		

First and Third Saturday – Non Instructional day

C.M. Belinda
13/6/22

Dr. M.J. Carmel Mary Belinda
Dean - Academics
in-charge

Vel Tech
Rangarajan Dr. Sagunthala

M. S. Sathya
13/6/22

Prof. S. Sathya
Vice-Chancellor

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1.7 Public Holiday - Notification

-4-

APPENDIX NOTIFICATION

Under the "Explanation" to section 25 of the Negotiable Instruments Act, 1881 (Central Act XXVI of 1881) read with Notification of the Government of India, Ministry of Home Affairs, No.20-25-26, Public-1, dated the 8th June 1957, the Government of Tamil Nadu hereby declares that, in addition to "Sundays" expressly defined as Public Holidays in the said "Explanation", the following days shall be Public Holidays for the year 2022.

ANNEXURE

Sl.No	Public Holidays	Date	Day
1.	New Year's Day	01.01.2022	Saturday
2.	Pongal	14.01.2022	Friday
3.	Thiruvalluvar Day	15.01.2022	Saturday
4.	Uzhavar Thirunal	16.01.2022	Sunday
5.	Thai Poesam	18.01.2022	Tuesday
6.	Republic Day	26.01.2022	Wednesday
7.	* Annual closing of Accounts for Commercial Banks & Co-operative Banks	01.04.2022	Friday
8.	Telugu New Year's Day	02.04.2022	Saturday
9.	Tamil New Year's Day / Dr. B.R.Ambedkar's Birthday/ Mahaveer Jayanthi	14.04.2022	Thursday
10.	Good Friday	15.04.2022	Friday
11.	May Day	01.05.2022	Sunday
12.	Ramzan (Idul Fitr)	03.05.2022	Tuesday
13.	Bakrid (Idul Azha)	10.07.2022	Sunday
14.	Muharram	09.08.2022	Tuesday
15.	Independence Day	15.08.2022	Monday
16.	Krishna Jayanthi	19.08.2022	Friday

p.t.o

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17.	Vinayakar Chaturthi	31.08.2022	Wednesday
18.	Gandhi Jayanthi	02.10.2022	Sunday
19.	Ayutha Pooja	04.10.2022	Tuesday
20.	Vijaya Dasami	05.10.2022	Wednesday
21.	Milad-un-Nabi	09.10.2022	Sunday
22.	Deepavali	24.10.2022	Monday
23.	Christmas	25.12.2022	Sunday

* Applicable only to Commercial Banks and Co-operative Banks in Tamil Nadu.

V. IRAI ANBU
CHIEF SECRETARY TO GOVERNMENT

//FORWARDED/BY ORDER//

[Handwritten signature]
SECTION OFFICER
[Handwritten date: 02/11/2022]



APPROVAL PROCESS 2022-23

Extension of Approval (EoA)

F.No. Southern/1-10970186537/2022/EOA

Date: 07-Jul-2022

To,

The Principal Secretary
 (Higher Education) Govt. of Tamil Nadu,
 N. K. M. Bld. 6th Floor Secretariat,
 Chennai-600009

Sub: Extension of Approval for the Academic Year 2022-23

Ref: Application of the Institution for Extension of Approval for the Academic Year 2022-23

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations, 2022 Notified on 4th February, 2022 and amended on 24th February 2022 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-3863975271	Application Id	1-10970186537
Name of the Institution	VEL TECH RANGARAJAN DR.SAGUNTHALA R AND D INSTITUTE OF SCIENCE AND TECHNOLOGY	Name of the Society/Trust	VEL TECH RANGARAJAN DR.SAGUNTHALA R&D INSTITUTE OF SCIENCE AND TECHNOLOGY
Institution Address	#42, AVADI -VEL TECH ROAD, AVADI, CHENNAI- 600062, TAMIL NADU., AVADI, THIRUVALLUR, Tamil Nadu, 600062	Society/Trust Address	#42, AVADI -VEL TECH ROAD, AVADI, CHENNAI- 600062, TAMIL NADU.,AVADI,THIRUVALLUR,Tam il Nadu,600062
Institution Type	Deemed to be University(Pvt)	Region	Southern
Year of Establishment	1996		

To conduct following Courses with the Intake indicated below for the Academic Year 2022-23

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
UNDER GRADUATE	ENGINEERI NG AND TECHNOLO GY	AERONAUTICAL ENGINEERING	NOT APPLICABLE	90	60	Yes	Yes
UNDER GRADUATE	ENGINEERI NG AND TECHNOLO GY	ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE	NOT APPLICABLE	60	60	Yes	Yes

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	NOT APPLICABLE	60	60	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	BIOMEDICAL ENGINEERING	NOT APPLICABLE	60	60	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	BIOTECHNOLOGY	NOT APPLICABLE	60	60	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	CIVIL ENGINEERING	NOT APPLICABLE	60	60	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE & ENGINEERING	NOT APPLICABLE	960	1104	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND DESIGN	NOT APPLICABLE	60	60	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)	NOT APPLICABLE	0	60##	NA	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)	NOT APPLICABLE	0	60##	NA	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)	NOT APPLICABLE	0	60##	NA	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRICAL AND ELECTRONICS ENGINEERING	NOT APPLICABLE	60	60	Yes	Yes

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	ELECTRONICS AND COMMUNICATION ENGINEERING	NOT APPLICABLE	570	480	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	INFORMATION TECHNOLOGY	NOT APPLICABLE	60	60	Yes	Yes
UNDER GRADUATE	ENGINEERING AND TECHNOLOGY	MECHANICAL ENGINEERING	NOT APPLICABLE	120	60	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	AERONAUTICAL ENGINEERING (Unmanned Aerial Vehicles)	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	STRUCTURAL ENGINEERING	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	ENVIRONMENTAL ENGINEERING	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	COMPUTER SCIENCE AND ENGINEERING	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	NETWORK ENGINEERING	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	BIG DATA ANALYTICS	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	EMBEDDED SYSTEMS AND TECHNOLOGIES	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	INFORMATION AND CYBER SECURITY	NOT APPLICABLE	18	18	NA	Yes

Level	Program	Course	Affiliating Body (University /Body)	Intake Approved for 2021-22	Intake Approved for 2022-23	NRI Approval Status	FN / Gulf quota/ OCI/ Approval Status
POST GRADUATE	MANAGEMENT	MBA	NOT APPLICABLE	90	120	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	POWER ELECTRONICS	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	METALLURGICAL AND MATERIAL SCIENCE ENGINEERING	NOT APPLICABLE	18	18	NA	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	INDUSTRIAL SAFETY AND ENGINEERING	NOT APPLICABLE	18	18	Yes	Yes
POST GRADUATE	ENGINEERING AND TECHNOLOGY	BIOTECHNOLOGY	NOT APPLICABLE	18	18	NA	NA

Approved New Course(s)

Course(s) Applied for Closure by the Institution for the Academic Year 2022-23

Level	Program	Course	Affiliating Body (Univ/Body)	Course Closure Status	Intake Approved for 2022-23
POST GRADUATE	MANAGEMENT	MBA (INNOVATION, ENTREPRENEURSHIP AND VENTURE DEVELOPMENT)	NOT APPLICABLE	Approved	0

It is mandatory to comply with all the essential requirements as given in APH 2022-23 (Appendix 6)

Important Instructions

1. The State Government/ UT/ Directorate of Technical Education/ Directorate of Medical Education shall ensure that 10% of reservation for Economically Weaker Section (EWS) as per the reservation policy for admission, operational from the Academic year 2019-20 is implemented without affecting the reservation percentages of SC/ ST/ OBC (NCL)/ General. However, this would not be applicable in the case of Minority Institutions referred to the Clause (1) of Article 30 of Constitution of India. Such Institution shall be permitted to increase in annual permitted strength over a maximum period of two years.
2. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time are now amalgamated as total intake and shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2022-23 for the Total Approved Intake. Further, the Institutions Deemed to be Universities/ Institutions having Accreditation/ Autonomy status shall have to maintain the Faculty: Student ratio as specified in the Approval Process Handbook. All such Institutions/ Universities shall have to create the necessary Faculty, Infrastructure and other facilities WITHIN 2 YEARS to fulfil the norms based on the Affidavit submitted to AICTE beginning with the Academic Year 2022-23
3. Strict compliance of Anti-Ragging Regulation, Establishment of Committee for SC/ ST, Establishment of Internal Complaint Committee (ICC), Establishment of Online Grievance Redressal Mechanism, Barrier Free Built Environment for disabled and elderly persons, Fire and Safety Certificate should be maintained as Approval Process Handbook and provisions made in AICTE Regulation notified from time to time.
4. In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

Pharmacy Institute: In compliance with the order dated 05.03.2020 passed by the Hon'ble Supreme Court of India in Transferred Petitions (CIVIL) No 87-101 of 2014, for the existing institutions offering courses in Pharmacy Programme, approval of Pharmacy Council of India (PCI) is mandatory and AICTE approval is NOT required. The requirements for running the Programme (Diploma / UG / PG) such as Land & Build-up Area, Student-faculty ratio, Intake etc. will be as per the respective regulatory body (PCI).

In case of any inconsistency in the course name and intake for EoA issued by AICTE and the approval by PCI, the approval of PCI shall prevail.

Architecture Institute: In compliance with the order dated 08.11.2019 passed by the Hon'ble Supreme Court of Indian CA No.364/ 2005, for the existing Institutions offering Courses in Architecture Programme, approval by the Council of Architecture (CoA) is mandatory and AICTE approval is NOT required. The requirements for running the Programme (Diploma / UG / PG) such as Land & Build-up Area, Student-faculty ratio, Intake etc. will be as per respective regulatory body (CoA). In case of any inconsistency in the course name and intake for EoA issued by AICTE and the approval by CoA, the approval of CoA shall prevail.

Deemed to be University: Institutions Deemed to be Universities (Running Technical Education Programmes), it is mandatory to have AICTE approval from the Academic Year 2018-19 in compliance of the Hon'ble Supreme Court Order dated 03-11-2017 passed in CA No.17869- 17870 /2017.

**Prof.Rajive Kumar
Member Secretary, AICTE**

Copy to:

1. **The Director Of Technical Education****, Tamil Nadu
2. **The Registrar****,
Not Applicable
3. **The Principal / Director**,
VEL TECH RANGARAJAN DR.SAGUNTHALA R AND D INSTITUTE OF SCIENCE AND TECHNOLOGY
#42, Avadi -Vel Tech Road, Avadi, Chennai- 600062, Tamil Nadu.,
Avadi,Thiruvallur,
Tamil Nadu,600062
4. **The Secretary / Chairman**,
#42, AVADI -VEL TECH ROAD, AVADI, CHENNAI- 600062, TAMIL NADU.
AVADI, THIRUVALLUR
Tamil Nadu,600062
5. **The Regional Officer**,
All India Council for Technical Education
Shastri Bhawan 26, Haddows Road

Chennai - 600 006, Tamil Nadu

6. Guard File(AICTE)

Note: Validity of the Course details may be verified at <http://www.aicte-india.org/>

** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

This is a computer generated Statement. No signature Required