

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E. in Mechatronics Engineering
Scheme of Teaching and Examinations 2021
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 - 22)

III SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	BSC 21MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Maths	2	2	0	0	03	50	50	100
2	IPCC 21MT32	Analog and Digital Electronics	TD: MT PSB: MT	3	0	2	1	03	50	50	100
3	IPCC 21MT33	Material Science and Manufacturing Technology	TD: MT PSB: MT	3	0	2	0	03	50	50	100
4	PCC 21MT34	Mechanics of solids and fluids	TD: MT PSB: MT	2	2	0	0	03	50	50	100
5	PCC 21MTL35	Machine Drawing and GD & T	TD: MT PSB: MT	0	0	2	0	03	50	50	100
6	UHV 21UH36	Social Connect and Responsibility	Any Department	0	0	1	0	01	50	50	100
7	HSMC 21KSK37/47	Samskrutika Kannada	TD and PSB: HSMC	1	0	0		01	50	50	100
	HSMC 21KBK37/47	Balake Kannada									
	OR										
	HSMC 21CIP37/47	Constitution of India and Professional Ethics									
8	AEC 21MT38X	Ability Enhancement Course – III	TD: Concerned department PSB: Concerned Board	If offered as Theory Course				01	50	50	100
				0	2	0					
				If offered as lab. course				02			
				0	0	2					
Total								400	400	800	

9	Scheduled activities for III to VIII semesters	NMDC 21NS83	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of the semester. The activities shall be carried out from (for 5 semesters) III semester to VIII semester. SEE in the above courses shall be considered during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered activities is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the results shall be reflected in the colander prepared for the NSS, PE and Yoga activities.						
		NMDC 21PE83	Physical Education (PE)(Sports and Athletics)	PE							
		NMDC 21YO83	Yoga	Yoga							

Course prescribed to lateral entry Diploma holders admitted to III semester B.E./B.Tech programs

1	NCMC 21MATDIP31	Additional Mathematics – I	Maths	02	02	--	--	---	100	---	100
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Note: BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, INT – Internship, HSMC: Humanity and Social Science Management Courses, AEC – Ability Enhancement Courses. UHV: Universal Human Value Course.

L – Lecture, T – Tutorial, P – Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination. TD- Teaching Department, PSB: Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and **21KBK37/47** Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 0 or 1. Teaching-Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulations governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

21INT49 Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will

SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete the internship subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non-credit mandatory courses (NCMC):

(A) Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE, 35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not met the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Ability Enhancement Course – III

21MT381	Programming in C++	21MT383	Mechatronics Ecosystem
21MT382	Trends in Digital Manufacturing	21MT384	Robotics Ecosystem

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IV SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	BSC 21MATCS41	Mathematical Foundations for Computing, Probability & Statistics	Maths	2	2	0		03	50	50	100
2	IPCC 21MT42	Electrical Drives and Control	TD: MT PSB: MT	3	0	2		03	50	50	100
3	IPCC 21MT43	Hydraulics and Pneumatics	TD: MT PSB: MT	3	0	2		03	50	50	100
4	PCC 21MT44	Microcontrollers and applications	TD: MT PSB: MT	3	0	0		03	50	50	100
5	AEC 21BE45	Biology For Engineers	BT, CHE, PHY	2	0	0		02	50	50	100
6	PCC 21MTL46	Mechatronics Lab	TD: MT PSB: MT	0	0	2		03	50	50	100
7	HSMC 21KSK37/47	Sanskrutika Kannada	HSMC	1	0	0		01	50	50	100
	HSMC 21KBK37/47	Balake Kannada									
	OR										
	HSMC 21CIP37/47	Constitution of India & Professional Ethics									
8	AEC 21MT48X	Ability Enhancement Course- IV	TD and PSB: Concerned department	If offered as theory Course				01	50	50	100
				1	0	0					
				If offered as lab. course				02			
				0	0	2					
9	UHV 21UH49	Universal Human Values	Any Department	1	0	0		01	50	50	100
10	INT 21INT49	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period of II and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.				3	100	--	100
Total								550	450	1000	

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

1	NCCM 21MATDIP41	Additional Mathematics - II	Maths	02	02	--	--	--	100	--	100
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L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

21KSK37/47 Sanskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 Balake Kannada is for non-Kannada speaking, reading, and writing students.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practicals of the same course. Credit for IPCC can be 0 or 1. Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from practical part of IPCC shall be included in the SEE question paper. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Non – credit mandatory course (NCCM):

Additional Mathematics - II:

(1) Lateral entry Diploma holders admitted to III semester of B.E./B.Tech., shall attend the classes during the IV semester to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the credit.

CIE marks. These courses are slated for CIE only and has no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses mandatory for the award of degree.

(3) Successful completion of the course Additional Mathematics II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics II shall be indicated as Unsatisfactory.

Ability Enhancement Course - IV

21MT481	Programming in Python (0-0-2)	21MT483	CNC programming and simulation (0-0-2)
21MT482	3-D Printing Technology (0-0-2)	21MT484	IoT (0-0-2)

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68 Innovation/ Entrepreneurship/ Societal based Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card. The internship shall be considered as a head of pass and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centers or Incubation centers. Innovation need not be a single major breakthrough, it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world.

Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are preferred place to learn the business ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she starts his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors including technology, small and medium-sized, and the service sector.

(3) Societal or social internship.

Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoys. Internship, is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living.

As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

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V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	BSC 21MT51	Theory of Machines and Machine Design	TD: MT PSB: MT	3	0	0		03	50	50	100
2	IPCC 21MT52	Micro and Smart System Technology	TD: MT PSB: MT	3	0	2		03	50	50	100
3	PCC 21MT53	Industrial Automation	TD: MT PSB: MT	3	0	2		03	50	50	100
4	PCC 21MT54	Control Theory and Virtual Instrumentation	TD: MT PSB: MT	3	0	0		03	50	50	100
5	PCC 21MTL55	Virtual Instrumentation Lab	TD: MT PSB: MT	0	0	2		03	50	50	100
6	AEC 21MT56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by university	2	0	0		02	50	50	100
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	1	0	0		1	50	50	100
8	AEC 21MT58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100
				1	0	0					
				If offered as lab. courses				02			
				0	0	2					
Total								400	400	800	

Ability Enhancement Course - IV

21MT581	MATLAB for Mechatronics (0-0-2)	21MT583	Finite Element Modelling and Analysis (0-0-2)
21MT582	Embedded systems (0-0-2)	21MT584	AI and ML (0-0-2)

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT –Internship, HSMC –Humanity and Social Science & Management Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 0. Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). Theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021 shall be referred.

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VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks
				L	T	P	S				
1	HSMC 21MT61	Condition Monitoring and Maintenance Management	Any Department	3	0	0		03	50	50	100
2	IPCC 21MT62	Programmable Logic Controller and SCADA Technology	TD: MT PSB: MT	3	0	2		03	50	50	100
3	PCC 21MT63	Industrial Robotics	TD: MT PSB: MT	3	0	0		03	50	50	100
4	PEC 21MT64x	Professional Elective Course-I	TD: MT PSB: MT	3	0	0		03	50	50	100
5	OEC 21XX65x	Open Elective Course-I	Concerned Department	3	0	0		03	50	50	100
6	PCC 21MTL66	Robotics Lab	TD: MT PSB: MT	0	0	2		03	50	50	100
7	MP 21MTMP67	Mini Project		Two contact hours /week for interaction between the faculty and students.				--	100	--	100
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.				--	100	--	100	
Total								500	300	800	

Professional Elective – I

21MT641	Power Electronics	21MT643	Automotive Electronics and Hybrid Vehicles
21MT642	Smart Factory and Industry 4.0	21MT644	Signal Processing

Open Electives – I offered by the Department to other Department students

21MT651	Automation in Manufacturing	21MT653	Mechatronics Engineering
21MT652	Electric and Hybrid Vehicles	21MT654	Micro Electro-Mechanical Systems

Note: HSMC: Humanity and Social Science & Management Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **PEC:** Professional Courses, **OEC**–Open Elective Course, **MP** –Mini Project, **INT** –Internship.

L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 0. Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech) may be referred.

Professional Elective Courses(PEC):

A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an opportunity to select one course out of five course. The minimum students' strength for offering professional electives is 10. However, this conditional shall not be applicable where the admission to the programme is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall **not be allowed** if,

- (i) The candidate has studied the same course during the previous semesters of the program.
- (ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- (iii) A similar course, under any category, is prescribed in the higher semesters of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medical, Agriculture, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the course details.

the details of expertise available to teach the same in the college.

The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is more than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skill development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Classwork and Research Internship /Industry Internship (21INT82)

Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend to VII semester classwork and similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Student Organizations established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.

The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent University examination after satisfying the internship requirements.

INT21INT82 Research Internship/ Industry Internship/Rural Internship

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with research and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It allows them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural internship: A long-term goal, as proposed under the AICTE rural internship programme, shall be counted as rural internship activity.

The student can take up Interdisciplinary Research Internship or Industry Internship.

The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.

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Swappable VII and VIII SEMESTER

VII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination			Credits	
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	T	P	S					
1	PCC 21MT71	Thermal Engineering	TD: MT PSB: MT	3	0	0		3	50	50	100	3
2	PCC 21MT72	Communication systems	TD: MT PSB: MT	2	0	0		3	50	50	100	2
3	PEC 21MT73X	Professional elective Course-II	TD: MT PSB: MT	3	0	0		3	50	50	100	3
4	PEC 21MT74X	Professional elective Course-III	TD: MT PSB: MT	3	0	0		3	50	50	100	3
5	OEC 21MT75X	Open elective Course-II	Concerned Department	3	0	0		3	50	50	100	3
6	Project 21MTP75	Project work		Two contact hours /week for interaction between the faculty and students.				3	100	100	200	10
Total								350	350	700	24	

VIII SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department	Teaching Hours /Week				Examination			Credits		
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks		Total Marks	
				L	T	P	S						
1	Seminar 21MT81	Technical Seminar		One contact hour /week for interaction between the faculty and students.				--	100	--	100	01	
2	INT 21INT82	Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.				03 (Batch wise)	100	100	200	15	
3	NCMC	21N S83	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester toVIII semester.				--	50	50	100	0
		21P E83	Physical Education (PE) (Sports and Athletics)	PE									
		21Y O83	Yoga	Yoga									
Total								250	150	400	16		

Professional Elective - II

21MT731	Digital Image Processing and Robot Vision	21MT734	Control Systems and Engineering
21MT732	Digital Controllers	21MT735	Additive Manufacturing
21MT733	Artificial Intelligence for Mechatronics		

Professional Elective – III

21MT741	VLSI (202)	21MT744	Computer Integrated Manufacturing
21MT742	Product Life Cycle Management and Concurrent Engineering	21MT745	Operations Research
21MT743	Mechatronics System Design		