VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Data Science

Scheme of Teaching and Examinations 2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

V SEN	IESTER												
				Teaching			Hours /Wee	ek		Exam	ination		
SI. No		ourse and urse Code	Course Title	Department (TD) and Question Paper Setting Board (PSB)	The ory Lect ure	T u t o ri a	Prac tical / Dra win g	SDA	Dur atio n in hou rs	CIE Mar ks	SEE Mark s	Total Mar ks	C r e d it s
					L	Т	Р	S					
1	PCC	BCS501	Software Engineering & Project Management	TD: DS PSB : DS	4	0	0		03	50	50	100	4
2	IPCC	BDS502	NoSQL Databases	TD: DS PSB: DS	3	0	2		03	50	50	100	4
3	PCC	BCS503	Theory of Computation	TD: DS PSB: DS	3	2	0		03	50	50	100	4
4	PCCL	BAIL504	Data Visualization Lab	TD: DS PSB: DS	0	0	2		03	50	50	100	1
5	PEC	BXX515x	Professional Elective Course	TD: DS PSB: DS	3	0	0		03	50	50	100	3
6	PROJ	BDS586	Mini Project	TD: DS PSB: DS	0	0	4		03	100		100	2
7	AEC	BRMK557	Research Methodology and IPR	TD: DS PSB: DS	2	2	0		02	50	50	100	3
8	HSMS	BCS508	Environmental Studies and E-waste Management	TD: HSM PSB : HSM	1	0	0		01	50	50	100	1
		BNSK559	National Service Scheme (NSS)	NSS coordinator									
9	MC	BPEK559	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	2			100		100	0
		BYOK559	Yoga	Yoga Teacher									
	- 								Total	500	300	800	22
			Pro	fessional Elective Cou	rse								

BAI515A	Computer Vision	BCS515C	Unix System Programming
BAD515B	Data Warehousing	BCS515D	Distributed Systems
		BAI515E	Exploratory Data Analysis

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L**: Lecture, **T**: Tutorial, **P**: Practical **S=SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SXX**: Semester End Evaluation. **K**: The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its 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 regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. 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 the 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 batches 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 the project report, project presentation skill, and question and answer session in the ratio 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.

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 option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Data Science

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VI SE	/IESTER			T .	1			_					
SI. No		urse and orse Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	The ory Lect ure	Teaching T u t o ri al	Practical / Drawin g	SDA	Dur atio n in hou rs	CIE Mar ks	SEE Mark S	Total Mark s	C r e d i t
1	IPCC	BDS601	Big Data Analytics	TD: DS PSB: DS	3	0	2		03	50	50	100	4
2	PCC	BDS602	Artificial Intelligence & Machine Learning	TD: DS PSB: DS	4	0	0		03	50	50	100	4
3	PEC	BDS613x	Professional Elective Course	TD: DS PSB: DS	3	0	0		03	50	50	100	3
4	OEC	BDS654x	Open Elective Course	TD: DS PSB: DS	3	0	0		03	50	50	100	3
5	PROJ	BDS685	Project Phase I	TD: DS PSB: DS	0	0	4		03	100		100	2
6	PCCL	BDSL606	Machine Learning lab	TD: DS PSB: DS	0	0	2		03	50	50	100	1
7					If the co	urse is c	ffered as a	Theory					
	AEC/SD C	BDS657x	Ability Enhancement Course/Skill Development Course V	TD: DS PSB: DS	1 If cours	0 e is off	0 ered as a p	oractical	01	50	50	100	1
					0	0	2						
		BNSK658	National Service Scheme (NSS)	NSS coordinator									
8	МС	BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	2			100		100	0
		BYOK658	Yoga	Yoga Teacher									
9	IKS	BIKS609	Indian Knowledge System		1	0	0		01	100	0	100	0

			Total	500	300	800	18
		Professional Elective Course				•	
BDS613A	Natural Language Processing	BDS613C	Blockchain Technology				
BDS613B	Exploratory Data Analysis	BDS613D	Time Series Analysis				
		Open Elective Course					
BDS654A	Introduction to Data Structures	BDS654C	Mobile Application Development				
BDS654B	Fundamentals of Operating Systems	BDS654D	Introduction to Al				

Ability Enhancement Course / Skill Enhancement Course-V

BDS657A	Explainable Al	BDS657C	Generative Al
BDS657B	PyTorch	BDS657D	Devops

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: The letter in the course code indicates common to all the stream of engineering. PROJ: Project /Mini Project. PEC: Professional Elective Course. PROJ: Project Phase -I, OEC: Open Elective Course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its 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 regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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 option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can

opt for 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. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

Project Phase-I : Students have to discuss with the mentor /guide and with their helphe/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Data Science

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2023-24)

				Teaching		Teaching	Hours /We	ek		Exam	ination		
SI. No		ourse and urse Code	Course Title	Department (and Questic Paper Settir Board (PSI	on The ory	T u t o ri al	Prac tical / Dra win g	SDA S	Dur atio n in hou rs	CIE Mar ks	SEE Mark s	Total Mark s	C r e d it s
1	IPCC	BDS701	Scalable Computing (cloud + Scalable Sytems)	TD: DS PSB: DS	3	0	2		03	50	50	100	4
2	IPCC	BDS702	Statistical Machine Learning for Data Science	TD: DS PSB: DS	3	0	2		03	50	50	100	4
3	PCC	BDS703	Data Security & Privacy	TD: DS PSB: DS	4	0	0		03	50	50	100	4
4	PEC	BDS714x	Professional Elective Course	TD: DS PSB: DS	3	0	0		03	50	50	100	3
5	OEC	BDS755x	Open Elective Course	TD: DS PSB: DS	3	0	0		01	50	50	100	3
6	PROJ	BDS786	Major Project Phase-II	TD: DS PSB: DS	0	0	12		03	100	100	200	6
										400	300	700	24
			Pr	ofessional Electi	ve Course								
BDS71	.4A	Deep Learning	<u> </u>	- 1	BDS714C		ngineering						
BDS71	.4B	Business Analy	rtics		BDS714D	Social	Network A	nalysis					

BDS755A	Introduction to DBMS	BDS755C	Software Engineering
BDS755B	Introduction to Algorithms	BDS755D	Data Management

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, PEC: Professional Elective Course, OEC: Open Elective Course PR: Project Work, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. TD- Teaching Department, PSB: Paper Setting department, OEC: Open Elective Course, PEC: Professional Elective Course. PROJ: Project work

Note: VII and VIII semesters of IV years of the program

- (1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships 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 or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

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 option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for 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. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21XXP75): The objective of the Project work is

- (i) To encourage independent learning and the innovative attitude of the students.
- (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- (iii) To impart flexibility and adaptability.
- (iv) To inspire team working.
- (v) To expand intellectual capacity, credibility, judgment and intuition.
- (vi) To adhere to punctuality, setting and meeting deadlines.
- (vii) To install responsibilities to oneself and others.
- (viii)To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

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

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Data Science

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

VIII SE	MESTER (S	wappable VII and	VIII SEMESTER)										
				Teaching	1	Teaching	Hours /Wee	k		Exam	ination		
SI. No		urse and urse Code	Course Title	Department (TD) and Question Paper Setting Board (PSB)	The ory Lect ure	T u t o ri al	Prac tical / Dra win g	SDA	Dur atio n in hou rs	CIE Mar ks	SEE Mark s	Total Mark s	C r e d it s
					L	Т	P	S					
1	PEC	BDS801x	Professional Elective (Online Courses) Only through NPTEL	PSB: DS	3	0	0		03	50	50	100	3
2	OEC	BDS802x	Open Elective (Online Courses) Only through NPTEL	PSB: DS	3	0	0		01	50	50	100	3
3	INT	BDS803	Internship (Industry/Research) (14 - 20 weeks)		0	0	12		03	100	100	200	10
										200	200	400	16

			Professional	Elective Cours	se (Online cours	es)			1	•	•			
BDS801A	BOS will publish co	ourses based on the availability			BDS801C									
BDS801B	BDS801B BDS801D													
	Open Elective Courses (Online Courses)													
BDS802A	BOS will publish co	ourses based on the availability			BDS802C									
BDS802B	DS802B BDS802D													

L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. TD- Teaching Department,

PSB: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester.
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.
- Note: For BDS801x and BDS802x courses BOS will announce list of courses in 6th, 7th & 8th Sem. Students can register in any of the semester to earn the credits in 8th Sem.

Elucidation:

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

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field 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 also helps 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: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's 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 the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. University shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

						Teaching	Hours /Wee	k		Exam	ination		
SI. No		ırse and rse Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Theory	1 Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	IPCC	BXX601			3	0	2	S	03	50	50	100	4
					_	-							
2	PCC	BXX602			4	0	0		03	50	50	100	4
3	PEC	BXX613x	Professional Elective Course		3	0	0		03	50	50	100	3
4	OEC	BXX654x	Open Elective Course		3	0	0		03	50	50	100	3
5	PCCL	BXXL606	Lab component		0	0	2		03	50	50	100	1
6					If the co	urse is o	ffered as a	Theory					
	- 4-		Ability Enhancement Course/Skill Development		1	0	0						_
	AEC/SDC	BXX657x	Course V		If cours	e is offe	red as a p	ractical	01	50	50	100	1
					0	0	2						
		BNSK658	National Service Scheme (NSS)	NSS coordinator									
7	MC	BPEK658	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	2			100		100	0
		BYOK658	Yoga	Yoga Teacher									

8	IKS	BIKS609	Indian Knowledge System	1	0	0	01	100	0	100	0
							Total	500	300	800	16

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in the title of the program

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2023-24)

					1	Гeaching	Hours /Wee	k		Exam	ination		
SI. No		urse and urse Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Theory	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
				Q	L	Т	Р	S				L	
1	IPCC	BXX701	To be completed in 5 th /6 th semester		3	0	2		03	50	50	100	4
2	IPCC	BXX702	To be completed in 5 th /6 th semester		3	0	2		03	50	50	100	4
3	PCC	BXX703	To be completed in the 6 th semester		4	0	0		03	50	50	100	3
4	PEC	BXX714x	Professional Elective Course (MOOC Courses)		3	0	0		03	50	50	100	3
5	OEC	BXX755x	Open Elective Courses (MOOC courses)		3	0	0		01	50	50	100	3
1	PEC	Bxx801x	Professional Elective (MOOC Courses)		3	0	0		03	50	50	100	3
2	OEC	Bxx802x	Open Elective (MOOC Courses)		3	0	0		01	50	50	100	3
3	PROJ	BXX883	Project - outcome of training		0	0	12		03	100	100	200	9
4	INT	Bxx804	Internship (Industry/Research) (02 semesters)		0	0	12		03	100	100	200	10
										200	200	400	42