VISVESVARAYA TECHNOLOGICAL UNIVERSITY BELAGAVI

Scheme of Teaching and Examination and Syllabus
B. E. NANO TECHNOLOGY (NT)
III-VIII SEMESTER
(Effective from Academic year 2018-19)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: NANO TECHNOLOGY

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT31	Transform Calculus, Fourier Series and Numerical Techniques	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18NT32	Foundations of Nanoscale Science and Technology	NT/Phy./Chem.	3	2	--	03	40	60	100	4
3	PCC	18NT33	Basics of Material Science	NT/ME/Phy./Chem.	3	0	--	03	40	60	100	3
4	PCC	18NT34	Physical and Chemical Principles of Nanotechnology	NT/Phy./Chem.	3	0	--	03	40	60	100	3
5	PCC	18NT35	Fundamentals of Bioscience	NT/BT/Chem.	3	0	--	03	40	60	100	3
6	PCC	18NT36	Synthesis and Processing of Nanomaterials	NT/Phy./Chem.	3	0	--	03	40	60	100	3
7	PCC	18NTL37	Simulation and Modeling Lab	NT/EC/EE	--	2	2	03	40	60	100	2
8	PCC	18NTL38	Digital Electronics Lab	NT/EC/EE	--	2	2	03	40	60	100	2
9	HSMC	18KVK39	Vyavaharika Kannada (Kannada for communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17 OR 18**	**08 OR 10**	**04**	**24 OR 26**	**420 OR 360**	**480 OR 540**	**900**	**24**

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39 Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

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

10	NCMC	18MATDIP31	Additional Mathematics - I	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech. programs shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. 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 F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.

(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B.Sc. degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to BE/B. Tech. /B. Plan. day college programme (For more details refer to Chapter 6,AICTE Activity Point Programme, Model Internship Guidelines):

Over and above the academic grades, everyday College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Outcome Based Education(OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2018 – 19)

Programme: NANO TECHNOLOGY

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BSC	18MAT41	Complex Analysis, Probability and Statistical Methods	Mathematics	2	2	--	03	40	60	100	3
2	PCC	18NT42	Applications of Nanotechnology	NT/Phy./Chem.	3	2	--	03	40	60	100	4
3	PCC	18NT43	Material Science and Engineering	NT/ME/Phy./Chem.	3	0	--	03	40	60	100	3
4	PCC	18NT44	Electronic Instruments and Measurements	NT/EC/EE	3	0	--	03	40	60	100	3
5	PCC	18NT45	Biochemistry and Microbiology	NT/BT/Chem.	3	0	--	03	40	60	100	3
6	PCC	18NT46	Engineering Materials and Surface Coating	NT/Phy./Chem.	3	0	--	03	40	60	100	3
7	PCC	18NTL47	Electronic Instrumentation Lab	NT/EC/EE/Phy.	--	2	2	03	40	60	100	2
8	PCC	18NTL48	Biochemistry and Microbiology Lab	NT/BT/Chem.	--	2	2	03	40	60	100	2
9	HSMC	18KVK39/49	Vyavaharika Kannada (Kannada for Communication)/	HSMC	--	2	--	--	100	--	100	1
		18KAK39/49	Aadalitha Kannada (Kannada for Administration)									
		OR										
		18CPC39/49	Constitution of India, Professional Ethics and Cyber Law		1	--	--	02	40	60		
					Examination is by objective type questions							
				TOTAL	**17**	**08**		**24**	**420**	**480**		
					OR	**OR**	**04**	**OR**	**OR**	**OR**	**900**	**24**
					18	**10**		**26**	**360**	**540**		

Note: BSC: Basic Science, PCC: Professional Core, HSMC: Humanity and Social Science, NCMC: Non-credit mandatory course.

18KVK39/49Vyavaharika Kannada (Kannada for communication) is for non-Kannada speaking, reading and writing students and 18KAK39/49Aadalitha Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

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

10	NCMC	18MATDIP41	Additional Mathematics - II	Mathematics	02	01	--	03	40	60	100	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE/B. Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. 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 F grade. In such a case, the students have to fulfill the requirements during subsequent semester/s to appear for SEE.
(b)These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs

Lateral entrant students from B.Sc. Stream, shall clear the non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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Programme: NANO TECHNOLOGY

V SEMESTER

Sl. No.	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMC	18NT51	Management and Entrepreneurship	HSMC	2	2	--	03	40	60	100	3
2	PCC	18NT52	Quantum Mechanics and Simulation Techniques	NT	3	2	--	03	40	60	100	4
3	PCC	18NT53	Characterization Techniques	NT/Phy.	3	2	--	03	40	60	100	4
4	PCC	18NT54	Synthesis of Nanomaterials	NT/Chem.	3	--	--	03	40	60	100	3
5	PCC	18NT55	Micro Fluidics and Nano fluids	NT	3	--	--	03	40	60	100	3
6	PCC	18NT56	Nano-Python Programming Language for Automation	NT/CS/EC	3	--	--	03	40	60	100	3
7	PCC	18NTL57	Nanomaterials Synthesis Lab	NT/Chem.	--	2	2	03	40	60	100	2
8	PCC	18NTL58	Characterization and Measurement Lab	NT/Phy.	--	2	2	03	40	60	100	2
9	HSMC	18CIV59	Environmental Studies	Civil/Environmental [Paper setting Board: Civil Engineering]	1	--	--	02	40	60	100	1
				TOTAL	**18**	**10**	**04**	**26**	**360**	**540**	**900**	**25**

Note: PCC: Professional Core, HSMC: Humanity and Social Science.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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Programme: NANO TECHNOLOGY

VI SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18NT61	Surface Science and Thin Film Technology	NT	3	2	--	03	40	60	100	4
2	PCC	18NT62	MEMS and NEMS	NT	3	2	--	03	40	60	100	4
3	PCC	18NT63	Nano-Photonics	NT	3	2	--	03	40	60	100	4
4	PEC	18NT64X	Professional Elective -1	NT	3	--	--	03	40	60	100	3
5	OEC	18NT65X	Open Elective -A	NT/Phy/Che.	3	--	--	03	40	60	100	3
6	PCC	18NTL66	Nanomaterial Surface Characterization and Thin Film Lab	NT	--	2	2	03	40	60	100	2
7	PCC	18NTL67	MEMS Simulation Lab	NT	--	2	2	03	40	60	100	2
8	MP	18NTMP68	Mini-project	NT	--	--	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
				TOTAL	**15**	**10**	**06**	**24**	**320**	**480**	**800**	**24**

Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.

Professional Elective -1

Course code under18NT64X	
18NT641	Composites and Their Applications
18NT642	Biomaterials
18NT643	Mechanical Operations

Open Elective -A

18NT651	Introduction to Nanoscience and Nanotechnology
18NT652	Nanomaterials and their applications
18NT653	Nanomaterials Synthesis and Characterization Techniques

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).
Selection of an open elective shall not be allowed if,

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

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work:
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 senior faculty members of the Department, one of whom shall be 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 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 college.
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 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.
SEE for Mini-project:
(i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.
Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. 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 subsequent University examination after satisfying the internship requirements.
AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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VII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18NT71	Nanoelectronics	NT/EC	4	--	--	03	40	60	100	4
2	PCC	18NT72	Molecular Biology and Genetic Engineering	NT/BT	4	--	--	03	40	60	100	4
3	PEC	18NT73X	Professional Elective - 2	NT/EC/BT	3	--	--	03	40	60	100	3
4	PEC	18NT74X	Professional Elective - 3	NT/ME/BT	3	--	--	03	40	60	100	3
5	OEC	18XX75X	Open Elective -B	NT/ME/CIV	3	--	--	03	40	60	100	3
6	PCC	18NTL76	Molecular Biology and Genetic Engineering Lab	NT/BT	--	--	2	03	40	60	100	1
7	Project	18NTP77	Project Work Phase - 1	NT	--	--	2	--	100	--	100	2
8	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters)								
				TOTAL	**17**	--	**04**	**18**	**340**	**360**	**700**	**20**

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective - 2

Course code under 18NT73X	Course Title
18NT731	MOSFETs and Digital Circuits
18NT732	Nanotechnology in Agriculture and Food Processing
18NT733	Nanodevices and Applications

Professional Electives - 3

Course code under 18NT74X	Course Title
18NT741	Fundamentals of Thermodynamics
18NT742	Green Nanotechnology
18NT743	Nanotechnology in Biomedical Engineering

Open Elective -B

18NT751	Applications of Nanotechnology in Electronics
18NT752	Nano-Tribology and Fracture Mechanics
18NT753	Nanomaterials for construction and Environmental applications

Students can select any one of the open electives offered by other Departments expect those that are offered by the parent Department (Please refer to the list of open electives under 18XX75X).

Selection of an open elective shall not be allowed if,

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

Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinaryproject can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) 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 phase -1, shall be based on the evaluation of the project work phase -1 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.

(ii) 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 phase -1, shall be based on the evaluation of project work phase -1 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.

Internship: All the students admitted to III year of BE/B. Tech. shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. 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 subsequent University examination after satisfying the internship requirements.
AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

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Programme: NANO TECHNOLOGY

VIII SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	18NT81	Bio-Nanotechnology	NT/BT	3	--	--	03	40	60	100	3
2	PEC	18NT82X	Professional Elective - 4	NT/EC/BT	3	--	--	03	40	60	100	3
3	Project	18NTP83	Project Work Phase - 2	NT	--	--	2	03	40	60	100	8
4	Seminar	18NTS84	Technical Seminar	NT	--	--	2	03	100	--	100	1
5	Internship	18NTI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
				TOTAL	**06**	--	**04**	**15**	**260**	**240**	**500**	**18**

Note: PCC: Professional Core, PEC: Professional Elective.

Professional Electives - 4

Course code under 18NT82X	Course Title
18NT821	Digital Systems Design
18NT822	Nano Toxicology
18NT823	Microcontrollers and Interface

Project Work

CIE procedure for Project Work Phase - 2:

(i) 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 phase -2, shall be based on the evaluation of project work phase -2 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.

(ii) 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 phase -2, shall be based on the evaluation of project work phase -2 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 for Project Work Phase - 2:

(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Internship: Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).