

# UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN



**B.Tech. 1<sup>ST</sup> –Year ( I Semester & II Semester )**

**Scheme of Examination & Syllabus**

**Academic Session 2018-19**

## B. Tech. I year Semester-Wise Evaluation Scheme

### I Semester

SI. No.	Course Code	Course Title	Contact Hours			Evaluation Scheme				Subject Total	Credits
						Seasonal Exam		ESE			
<b>THEORY COURSES</b>											
			L	T	P	CT	TA	Total	ESE		
1	BSCT101	Mathematics –I	3	1	0	30	20	50	100	150	4
2	BSCT102/ BSCT103	*Physics/ Chemistry	3	1	0	30	20	50	100	150	4
3	BHST101	English	2	0	0	30	20	50	50	100	2
4	BCST101 / BEET101	Programming for Problem Solving / Basic Electrical Engineering	3	1	0	30	20	50	100	150	3
5	Induction Program		3 Weeks duration								
<b>PRACTICAL/TRANNING/PROJECT</b>											
1	BSCP102/ BSCP103	Physics/ Chemistry Lab	0	0	3	-	25	25	25	50	1.5
2	BHSP101	Language Lab	0	0	2	-	25	25	25	50	1
3	BCSP101 / BEEP101	Programming for Problem Solving Lab / Basic Electrical Engineering			3	-	25	25	25	50	2
		Total	11	2	8					700	17.5

### II Semester

SI. No.	Course Code	Course Title	Contact Hours			Evaluation Scheme				Subject Total	Credits
						Seasonal Exam		ESE			
<b>THEORY COURSES</b>											
			L	T	P	CT	TA	Total	ESE		
1	BSCT201	Mathematics –II	3	1	0	30	20	50	100	150	4
2	BSCT202/ BSCT203	*Physics/ Chemistry	3	1	0	30	20	50	100	150	4
3	BCST201 / BEET201	Programming for Problem Solving / Basic Electrical Engineering	3	1	0	30	20	50	100	150	4
	BEST201	Environmental Sciences	2	0	0	-	-	-	50	50	-
<b>PRACTICAL/TRANNING/PROJECT</b>											
1	BSCP202/ BSCP203	Physics/ Chemistry Lab	0	0	3	-	25	25	25	50	1.5
2	BMEP201	Workshop/ Manufacturing Practices	1	0	3	-	50	50	50	100	3
3	BMEP202	Engineering Graphics & Design	1	0	3	-	50	50	50	100	3
4	BCSP201 / BEEP201	Programming for Problem Solving Lab / Basic Electrical Engineering	0	0	2	-	25	25	25	50	1.5
		Total	11	3	11	-	-	-	-	950	21

\* Physic Syllabus is varied from branch to branch

## Induction Program

(Please refer for guidelines. Details of Induction program also available in the curriculum of Mandatory courses.)

<b>Induction program (mandatory)</b>	<b>3 weeks duration</b> (Please refer Appendix-A for guidelines & also details available in the curriculum of Mandatory courses)
Induction program for students to be offered right at the start of the first year.	<ul style="list-style-type: none"><li>• Physical activity</li><li>• Creative Arts</li><li>• Universal Human Values</li><li>• Literary</li><li>• Proficiency Modules</li><li>• Lectures by Eminent People</li><li>• Visits to local Areas</li><li>• Familiarization to Dept./Branch &amp; Innovations</li></ul>

# A Guide to Induction Program

## 1 Introduction

*(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.<sup>1</sup> This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.)*

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them

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<sup>1</sup>A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs. work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

## 2 Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.<sup>2</sup>

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

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<sup>2</sup> Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gandhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsory course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member.

Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

## 2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

## 2.2 Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

## 2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and don't's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.<sup>3</sup>

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

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<sup>3</sup>The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

## 2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

## 2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

## 2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

## 2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

## 2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

# 3 Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

## 3.1 Initial Phase

<i>Time</i>	<i>Activity</i>
Day 0	
Whole day	<i>Students arrive - Hostel allotment. (Preferably do pre-allotment)</i>
Day 1	
09:00 am - 03:00 pm	<i>Academic registration</i>
04:30 pm - 06:00 pm	<i>Orientation</i>
Day 2	
09:00 am - 10:00 am	<i>Diagnostic test (for English etc.)</i>
10:15 am - 12:25 pm	<i>Visit to respective depts.</i>

12:30 pm - 01:55 pm	Lunch
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group.
	(Same as Universal Human Values groups)

### 3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

#### 3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	Time	Activity	Remarks
	Day 3 onwards		
	06:00 am	Wake up call	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	Bath, Breakfast, etc.	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	Lunch	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	Break / light tea	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	Rest and Dinner	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

#### 3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	Session	Remarks
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Familiarization	with	IV	For 3 days (Day 3 to 5)
Dept/Branch & Innovations			
Visits to Local Area		IV, V and	For 3 days - interspersed (e.g., 3
		VI	Saturdays)
Lectures by Eminent People		IV	As scheduled - 3-5 lectures
Literary (Play /	Book	IV	For 3-5 days
Reading / Lecture)			
Proficiency Modules		V	Daily, but only for those who need it

### 3.3 Closing Phase

<i>Time</i>	<i>Activity</i>
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 pm - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

### 3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline<sup>4</sup>.

Here we list some important suggestions which have come up and which have been experimented with.

#### 3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

#### 3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters.

It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

## 4. Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.

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<sup>4</sup>We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

Code	Subject Name	L	T	P
BSCT 101	Engineering Mathematics - I	3	1	0

Common to all B.Tech. branches except B.Tech. Biotechnology and B.Tech. Agricultural Engineering. (Effective from the Session: 2018 – 2019)

**OBJECTIVES:** The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:

- To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.
- To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To familiarize the student with functions of several variables that is essential in most branches of engineering.
- To develop the essential tool of matrices and linear algebra in a comprehensive manner.

**Unit 1: Matrices** **10**  
**hours**

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Hermitian and skew-Hermitian matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem and its applications, and Orthogonal transformation.

**Unit 2: Calculus – I** **6**  
**hours**

Rolle's Theorem, Lagrange's Mean value theorems and Cauchy Mean value theorem, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

**Unit 3: Calculus – II** **8**  
**hours**

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions

**Unit 4: Sequences and series** **10**  
**hours**

Convergence of sequence and series, tests for convergence (Ratio test, D' Alembert's test, Raabe's test); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

**Unit 5: Multivariable Calculus (Differentiation)** **8**  
**hours**

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Approximation of errors, Method of Lagrange multipliers; Gradient, curl and divergence.

**Textbooks/References:**

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. U.S. Rana, Engineering Mathematics for First Semester, Anand Publications, 2008
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Theory	3	1	0

**Prescribed for: Computer Science Engineering & Information Technology**

**Course Outcomes:** After successful completion of the course, the students should be able to  
CO1: Understand the basic knowledge about basics of quantum mechanics and semi- conductor materials,

CO2: Know the conceptual physics and its use in solving the physical problems.

CO3: Apply the principles of physics.

CO4: Describe the physics in his /her words.

CO5: Identify the reasons for physical happenings.

**UNIT-I**

**8 hours**

**Quantum Mechanics:** Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born's interpretation of the wave function, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box

**UNIT-II**

**8 hours**

**Electronic materials:** Free electron theory of metals, quantum theory of free electrons, Fermi level, density of states, Energy bands in solids, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level,

**Semiconductors:** Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), concentration of charge carriers, Carrier generation and recombination, Carrier transport: diffusion and drift. **8 hours**

**UNIT-III**

**8 hours**

**Semiconductor devices:** Structure of p-n junction, rectifier equation, zener diode, tunnel diode, light emitting diode, Metal-semiconductor junction (Ohmic and Schottky), field effect transistors, Semiconductor materials of interest for optoelectronic devices. Four probe measurement for carrier density and resistivity, diode I-V characteristics.

**UNIT-IV**

**8 hours**

**Light-semiconductor interaction:** Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model

**UNIT-V**

**8 hours**

**Engineered semiconductor materials:** Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Heterojunctions and associated band-diagrams.

**References:**

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007)
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008)
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007)
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Theory	3	1	0

**Prescribed for: 1. Electronics & Communication Engineering, Instrumentation & Control Engineering, Electrical Engineering, Electronic & Telecommunication Engineering, Applied Electronics and Instrumentation**

**Course Outcomes:** After successful completion of the course, the students should be able to

CO1: Understand the basic knowledge about oscillations and waves, diffraction of optical waves, laser, quantum mechanics and its role in semi-conductor materials,

CO2: Know the conceptual physics and its use in solving the physical problems.

CO3: Apply the principles of physics.

CO4: Describe the physics in his /her words.

CO5: Identify the reasons for physical happenings.

### UNIT-I

**8hours**

**Oscillations and waves:** Introduction, characteristics of SHO; Damped harmonic oscillator, damping of an oscillator; Forced vibrations - velocity, total energy and power of forced harmonic oscillator; Displacement resonance - resonance amplitude, sharpness of resonance; Quality factor of forced harmonic oscillator, Coupled oscillators- symmetric and anti-symmetric modes. Wave as a periodic variation quantity in space and time- wave equation, wave equation in differential form, longitudinal and transverse waves, stationary waves.

### UNIT-II

**8hours**

**Interference and Diffraction of light:** Superposition of wave and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit and double slit for normal incidence, intensity distribution; diffraction grating for normal incidence (N parallel slits), Rayleigh criterion of resolution and resolving power of grating.

**Lasers:** Absorption of radiation, spontaneous and stimulated emission of radiation, Einstein's coefficients, basic requirements of laser system-population inversion, optical pumping, Helium-Neon, carbon dioxide and Ruby lasers. Applications of laser. 8hours

### Unit-III

**8hours**

**Introduction to Quantum Mechanics:** Introduction, need of quantum mechanics, Basis of quantum mechanics, de-Broglie principle and wave packet; particle, group and phase velocities and their relationships, Schrödinger's time independent and dependent wave equations, energy and momentum operators, Eigen values and Eigen functions, expectation values of physical quantities (position, momentum and energy).

### Unit-IV

**8hours**

**Solution of Wave Equation:** Solution of stationary-state Schrodinger equation for one dimensional problems—particle in a box, square-well potential. Reflection and transmission coefficients from a potential barrier and tunnel effect; Qualitative description of tunnel effect in related examples like alpha-decay, scanning tunneling microscope, tunneling in semiconductor tunnel-diode.

### Unit-V

**8hours**

**Introduction to Solids and Semiconductors:** Drude-Lorentz free electron theory of metals, success in explaining drift velocity, relaxation time, current density, conductivity, resistivity

and ohm's law; Wiedmann-Franz law, Drude's theory of conduction of heat, failure of classical free electron theory. Quantum theory of free electron, Fermi level, density of states, Fermi-Dirac distribution function, Bloch's theorem for particles in a periodic potential, Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature. Carrier generation and recombination, Carrier transport: diffusion and drift in p-n junction. 8hours

**Text / References:**

1. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.
2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
3. E. Hecht, "Optics", Pearson Education, 2008.
4. A. Ghatak, "Optics", McGraw Hill Education, 2012.
5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
6. D. J. Griffiths, "Quantum mechanics", Pearson Education, 2014.
7. R. Robinett, "Quantum Mechanics", OUP Oxford, 2006.
8. D. McQuarrie, "Quantum Chemistry", University Science Books, 2007.
9. D. A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
10. E.S. Yang, "Microelectronic Devices", McGraw Hill, Singapore, 1988.
11. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Theory	3	1	0

**Prescribed for : Mechanical Engineering, Automobile Engineering ,Industrial and Production Engineering, Mechatronics, Production Engineering**

**Course Outcomes:** After successful completion of the course, the students should be able to

**CO1:** Understand the basic knowledge about oscillations and waves, diffraction of optical waves, laser, quantum mechanics and its role in semi-conductor materials,

**CO2:** Know the conceptual physics and its use in solving the physical problems.

**CO3:** Apply the principles of physics.

**CO4:** Describe the physics in his /her words.

**CO5:** Identify the reasons for physical happenings.

**UNIT-I (8hours)**

**Waves & oscillations I:**

Simple harmonic motion, damped and forced simple harmonic oscillator, Mechanical and electrical simple harmonic oscillators, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator.

**UNIT-II (8hours)**

**Waves & oscillations II:**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion, Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigen frequencies, longitudinal waves and the wave equations, acoustics waves and speed of sound, standing sound waves.

Waves with dispersion, water waves, superposition of waves, wave groups and group velocity.

**UNIT-III (8hours)**

**Electrostatics I:**

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction, Practical examples like Farady's cage and coffee-ring effect, Boundary conditions of electric field and electrostatic potential, method of images with simple examples, energy of a charge distribution and its expression in terms of electric field.

**UNIT-IV (8hours)**

**Electrostatics II:**

Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, boundary conditions on displacement, Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

### UNIT-III

(8hours)

#### Magnetostatics & LASERS

Bio-Savart law, Divergence and curl of static magnetic field, vector potential and calculating it for a given magnetic field using Stokes' theorem, the equation for the vector potential and its solution for given current densities.

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers Ruby laser, He-Ne and CO<sub>2</sub> laser, properties and applications of lasers.

**Text /Reference Books:** For Electromagnetics

(i) David Griffiths, Introduction to Electrodynamics, Pearson Education India Learning Private Limited, 4<sup>th</sup> Edition (2015).

(ii) Halliday, Resnick, Walker Fundamentals of Physics, Wiley India Pvt. Ltd; 10<sup>th</sup> Edition (2015).

(iii) W. Saslow, Electricity, magnetism and light, Academic Press, 1<sup>st</sup> Edition (2002).

(iv) Ian G. Main, Vibrations and waves in physics, Cambridge University Press (1978).

(v) H.J. Pain, The physics of vibrations and waves, Wiley India Pvt. Ltd; 6<sup>th</sup> Edition (2010).

(vi) E. Hecht, Optics, Pearson Education, India. 4<sup>th</sup> Edition (2008).

(vi) A. Ghatak, Optics, Tata McGraw-Hill Education India, 5<sup>th</sup> Edition (2012).

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Theory	3	1	0

**Prescribed for: Civil Engineering, Chemical Engineering, Plastic & Polymer Engineering, Petroleum Engineering**

**Course Outcomes:** At the end of the course, the student will be able to

CO1: Understand the vector mechanics for a classical system.

CO2: Identify various types of forces in nature, frames of references, and conservation laws.

CO3: Know the Newton's equations of motion in polar, cylindrical and spherical coordinated.

CO4: Apply the knowledge obtained in this course to related problems such as weather systems, Foucault pendulum; Harmonic oscillator, etc.

CO5: Analyze the planar rigid body dynamics of the 2-Dimensional and 3-Dimensional system.

**UNIT-I**

**(8 hours)**

**Vector mechanics of particles**

Physical significance of gradient, Divergence and curl. Potential energy function;  $F = -\text{Grad } V$ , equipotential surfaces. Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law. Introduction to Cartesian, spherical and cylindrical coordinate system. Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits. Non-inertial frames of reference; Rotating coordinate system: - Centripetal and Coriolis accelerations; Foucault pendulum.

**UNIT-II**

**(8 hours)**

**Simple harmonic motion, damped and forced simple harmonic oscillator**

Mechanical and electrical simple harmonic oscillators, damped oscillations, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, resonance.

**UNIT-III**

**(8 hours)**

**Planar rigid body Mechanics**

Definition and motion of a rigid body in the plane; Rotation in the plane, Angular momentum about a point of a rigid body in planar motion; centre of mass, moment of inertia, theorems of moment of inertia, inertia of plane lamina, circular ring, moment of force, couple, Euler's laws of motion. Introduction to threedimensional rigid body motion.

**UNIT-IV**

**(8 hours)**

**Mechanical Properties of Materials**

Concepts of stress and strain, Stress-Strain diagrams; Tensile test; Elastic deformation, Plastic deformation. Bending stress; Shear stress; Concept of strain energy; Yield criteria. Impact Testing & toughness behavior. Hardness of materials, Imperfections and dislocations

**UNIT-V**

**(8 hours)**

**Mechanics of solids**

Friction, Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; motion on horizontal and inclined planes. Methods of reducing friction, Concepts

of elasticity, plasticity, strain hardening, failure (fracture / yielding), Generalized Hooke's law. Force analysis - axial force, shear force, bending moment and twisting moment.

Reference books:

1. Engineering Mechanics, 2nd ed. - MK Harbola
2. Introduction to Mechanics - MK Verma
3. An Introduction to Mechanics - D Kleppner & R Kolenkow
4. Principles of Mechanics - JL Synge & BA Griths
5. Mechanics - JP Den Hartog
6. Engineering Mechanics- Dynamics, 7th ed. - JL Meriam
7. Mechanics Vibrations - JP Den Hartog
8. Theory of Vibrations with Applications — WT Thomson
9. An Introduction to the Mechanics of Solids, 2nd ed. with SI Units-SH Crandall, NC Dahl & TJ Lardner
10. Classical Mechanics: H. Goldstein, Pearson Education Asia.
11. Classical mechanics of particles and rigid bodies: K.C Gupta, Wiley eastern New Delhi.
12. Engineering Mechanics: Statics, 7th ed.-JL Meriam
13. Modern's Analytical Mechanics, Satish K Gupta

Code	Subject Name	L	T	P
BSCT 103	Chemistry (Concepts in chemistry for engineering)	3	1	0

### Detailed contents

#### (i) Atomic and molecular structure (12 hours)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

#### (ii) Spectroscopic techniques and applications (8 hours)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

#### (iii) Intermolecular forces and potential energy surfaces (4 hours)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H<sub>3</sub>, H<sub>2</sub>F and HCN and trajectories on these surfaces.

#### (iv) Use of free energy in chemical equilibria (6 hours)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

#### (v) Periodic properties (4 hours)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

#### (vi) Stereochemistry (4 hours)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

#### (vii) Organic reactions and synthesis of a drug molecule (4 hours)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

### Suggested Text Books

- (i) University chemistry, by B. H. Mahan
- (ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
- (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
- (iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
- (v) Physical Chemistry, by P. W. Atkins
- (vi) Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>

### Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

Rationalise bulk properties and processes using thermodynamic considerations.

Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques

Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

List major chemical reactions that are used in the synthesis of molecules.

Code	Subject Name	L	T	P
<b>BHST 101</b>	<b>English</b>	<b>2</b>	<b>3</b>	<b>0</b>

**Detailed content.**

**1. Vocabulary Building**

- 1.1 The concept of Word Formation
- 1.2 Root words from foreign languages and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- 1.4 Synonyms, antonyms, and standard abbreviations.

**2. Basic Writing Skills**

- 2.1 Sentence Structures
- 2.2 Use of phrases and clauses in sentences
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence
- 2.5 Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

**3. Identifying Common Errors in Writing**

- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Prepositions
- 3.6 Redundancies
- 3.7 Clichés

**4. Nature and Style of sensible Writing**

- 4.1 Describing
- 4.2 Defining
- / 4.3 Classifying
- / 4.4 Providing examples or evidence
- 4.5 Writing introduction and conclusion

**5. Writing Practices**

- 5.1 Comprehension
- 5.2 Précis Writing
- 5.3 Essay Writing

**6. Oral Communication**

(This unit involves interactive practice sessions in Language Lab) Listening Comprehension  
Pronunciation, Intonation, Stress and Rhythm

Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

**Suggested Readings:**

- (i) Practical English Usage. Michael Swan. OUP. 1995.
- (ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
- (iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
- (iv) Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- (v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Code	Subject Name	L	T	P
BCST 101 for 1 <sup>st</sup> sem & BCST 201 for 2 <sup>nd</sup> sem	Programming for Problem Solving (with C)	3	0	0

### Detailed contents

#### Unit 1: Introduction to Programming(4 hours)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 hours)**.

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm Flowchart/Pseudocode with examples. **(1 hours)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 hours)**

#### Unit 2: Arithmetic expressions and precedence(2 hours)

#### Unit 2: Conditional Branching and Loops (6 hours)

Writing and evaluation of conditionals and consequent branching **(3 hours)**

Iteration and loops **(3 hours)**

#### Unit 3: Arrays(6 hours)

Arrays (1-D, 2-D), Character arrays and Strings

#### Unit 4: Basic Algorithms(6 hours)

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

#### Unit 5: Function(5 hours)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

#### Unit 6: Recursion(4 -5 hours)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

#### Unit 7: Structure(4 hours)

Structures, Defining structures and Array of Structures

#### Unit 8: Pointers(2 hours)

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

**Unit 9:** File handling (only if time is available, otherwise should be done as part of the lab)

### Suggested Text Books

- (i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
- (ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

### Suggested Reference Books

- (i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

**Course Outcomes:** The student will learn

To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).To test and execute the programs and correct syntax and logical errors.

To implement conditional branching, iteration and recursion. To decompose a problem into functions and synthesize a complete program using divide and conquer approach. To use arrays, pointers and structures to formulate algorithms and programs. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems. To apply programming to solve simple numerical method problems, namely root finding of function, differentiation of function and simple integration.

Code	Subject Name	L	T	P
BEET 101 for 1 <sup>st</sup> sem & BEET 201 for <sup>nd</sup> sem	Basic Electrical Engineering	3	1	0

### Course Outcomes:

- At the end of this course, students will demonstrate the ability
- To understand and analyse basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters. To introduce the components of low-voltage electrical installations.

#### Module 1 : DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

#### Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

#### Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

#### Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

#### Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

#### Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

### Text / References:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Code	Subject Name	L	T	P
BSCT 102	Engineering Mathematics - II	3	1	0

Common to all B.Tech. branches except B.Tech. Biotechnology and B.Tech. Agricultural Engineering. (Effective from the Session : 2018 – 2019)

**OBJECTIVES:**

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
- To introduce effective mathematical tools for the solutions of differential equations that model physical processes.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.

**Unit 1: First order ordinary differential equations: 6 hours**

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for  $p$ , equations solvable for  $y$ , equations solvable for  $x$  and Clairaut's type.

**Unit 2: Ordinary differential equations of higher orders: 8 hours**

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

**Unit 3: Multivariable Calculus (Integration): 10 hours**

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes (without proof) simple applications involving cubes, sphere and rectangular parallelepipeds.

**Unit 4: Complex Variable – Differentiation: 8 hours**

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

**Module 5: Complex Variable – Integration: 8 hours**

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof);

Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. 3. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. U.S. Rana, Engineering Mathematics for Second Semester, Anand Publications, 2008
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Code	Subject Name	L	T	P
BSCP 102 for 1 <sup>st</sup> sem / BSCP 202 for 2 <sup>nd</sup> sem	Physics Practical	0	0	3

**Prescribed for: Computer Science Engineering & Information Technology**

### Course Outcomes:

After successful completion of the applied physics laboratory course, students should be able to:

CO1: verify the theoretical formulations/ concepts of physics.

CO2: know the art of recording the observations of an experiment scientifically.

CO3: learn by doing.

CO4: handle and operate the various elements/parts of an experiment.

CO5: understand the importance of an experiment in engineering & technology.

### List of Experiments

1. To verify the inverse square law of radiation using Photoelectric effect.
2. To determine the value of Planck's constant and photoelectric work function of the material of the cathode using photoelectric cell.
3. To determine the frequency of an unknown signal by drawing the Lissajous patterns for various frequency ratios and evaluative the phase difference between two sinusoidal signals applied to X and Y inputs of cathode ray oscilloscope.
4. Determination of the value of e/m of an electron by helical method/Thomson method.
5. To verify the existence of Bohr's energy levels with Frank-Hertz apparatus.
6. To study the V-I characteristics of semiconductor diode.
7. To find the band gap of the semiconductor material using diode in reverse bias.
8. To draw the V-I characteristics of a silicon controlled rectifier.
9. To study the common base and common emitter characteristics of PNP/NPN junction transistor.
10. To determine the numerical aperture (NA) of a given multimode optical fibre by using laser beam.
11. To study the characteristics of metal-oxide-field-effect transistor.
12. To determine the resistivity and energy band gap by four probe method

**Note: Additional experiments may be added based on contents of syllabus.**

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Practical	0	0	3

**Prescribed for: 1. Electronics & Communication Engineering, Instrumentation & Control Engineering, Electrical Engineering, Electronic & Telecommunication Engineering, Applied Electronics and Instrumentation**

**Course Outcomes:** After successful completion of the applied physics laboratory course, students should be able to:

CO1: verify the theoretical formulations/ concepts of physics.

CO2: know the art of recording the observations of an experiment scientifically.

CO3: learn by doing.

CO4: handle and operate the various elements/parts of an experiment.

CO5: understand the importance of an experiment in engineering & technology.

### List of Experiments

1. To verify the inverse square law of radiation using Photoelectric effect.
2. To determine the value of Planck's constant and photoelectric work function of the material of the cathode using photoelectric cell.
3. To determine the frequency of an unknown signal by drawing the Lissajous patterns for various frequency ratios and evaluate the phase difference between two sinusoidal signals applied to X and Y inputs of cathode ray oscilloscope.
4. To determine the wavelength of He-Ne laser by diffraction method.
5. Use of Michelson-Morley interferometer for determining the wavelength of He-Ne laser.
6. Determination of the value of  $e/m$  of an electron by helical method/Thomson method.
7. To determine the numerical aperture (NA) of a given multimode optical fibre by using laser beam.
8. To investigate resonance in forced oscillations and to find the spring constant.
9. To find the wavelength of sodium light by measuring the diameter of Newton's rings.
10. To determine the specific rotation of sugar solution using Laurent's half-shade polarimeter.
11. To verify the existence of Bohr's energy levels with Frank-Hertz apparatus.
12. To find the band gap of the semiconductor material using diode in reverse bias.

**Note: Additional experiments may be added based on contents of syllabus.**

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Practicals	0	0	3

**Prescribed for : Mechanical Engineering, Automobile Engineering ,Industrial and Production Engg., Mechatronics ,Production Engineering**

**Course Outcomes:** After successful completion of the applied physics laboratory course, students should be able to:

- CO1: verify the theoretical formulations/ concepts of physics.
- CO2: know the art of recording the observations of an experiment scientifically.
- CO3: learn by doing.
- CO4: handle and operate the various elements/parts of an experiment.
- CO5: understand the importance of an experiment in engineering & technology.

#### **List of Experiments**

1. To find the Curie temperature of the given ferrite material.
2. Determination of the value of  $e/m$  of an electron by helical method/Thomson method.
3. To find the capacitance and permittivity of the given material.
4. To calculate the dielectric constant of the given dielectric material.
5. To investigate resonance in forced oscillations and to find the spring constant.
6. To determine the frequency of a tuning fork using sonometer.
7. To determine the frequency of an electrically maintained tuning fork by Melde's experiment.
8. To find the refractive index of the material of given prism using spectrometer.
9. To determine the wavelength of He-Ne laser by diffraction method.
10. To determine the numerical aperture (NA) of a given multimode optical fibre by using laser beam.
11. To determine the specific rotation of sugar solution using Laurent's half-shade polarimeter.

**Note: Additional experiments may be added based on contents of syllabus.**

Code	Subject Name	L	T	P
BSCT 102 for 1 <sup>st</sup> sem / BSCT 202 for 2 <sup>nd</sup> sem	Physics Practical	0	0	3

**Prescribed for: Prescribed for: Civil Engineering Branch, Chemical Engineering, Plastic & Polymer Engineering, Petroleum Engineering**

**Course Outcomes:** At the end of the course, the student will be

CO1 Able to understand the concepts learned in the mechanics of solids.

CO2 Learning the skills needed to verify some of the concepts of theory courses.

CO3 Trained in carrying out precise measurements and handling sensitive equipment.

CO4 Able to understand the principles of error analysis and develop skills in experimental design.

CO5 Able to document a technical report which communicates scientific information in a clear and concise manner.

### List of Experiments

1. Measurements of length (or diameter) using vernier caliper, screw gauge, and travelling microscope.
2. To determine the Height of an object using a Sextant.
3. To determine the angular acceleration  $\alpha$  and torque  $\tau$  of flywheel.
4. To determine the Moment of Inertia of a Flywheel.
5. To verify that fundamental frequency of vibration of a steel bar clamped at one end is inversely proportional to the square of its length and measure the Young's modulus of bar.
6. To determine the Young's Modulus of a Wire by Optical Lever Method.
7. To determine the Elastic Constants/Young's Modulus of a Wire by Searle's method.
8. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
9. To determine the Modulus of Rigidity of brass.
10. To determine g by Bar Pendulum.
11. To determine g by Kater's Pendulum.
12. To determine g and velocity for a freely falling body using Digital Timing Technique.
13. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g and (c) Modulus of rigidity.
14. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
15. To compare the moment of inertia of a solid sphere and hollow sphere or solid disc of same mass with the torsional pendulum.
16. To study the variation of time period with distance between centre of suspension and centre of gravity for a bar pendulum and to determine: (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of g in the laboratory.

**Note: Additional experiments may be added based on contents of syllabus.**

Code	Subject Name	L	T	P
BSCP 103 for 1 <sup>st</sup> sem / BSCP 203 for 2 <sup>nd</sup> sem	Chemistry Laboratory	0	0	3

**Choice of 10-12 experiments from the following:**

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
  
- Determination of chloride content of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

**Laboratory Outcomes**

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

Estimate rate constants of reactions from concentration of reactants/products as a function of time

Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc

Synthesize a small drug molecule and analyse a salt sample.

Code	Subject Name	L	T	P
BCSP 101 for 1 <sup>st</sup> sem & BCSP 201 for 2 <sup>nd</sup> sem	Laboratory Programming for Problem Solving (with C)	0	0	3

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

**Tutorial 1:** Problem solving using computers:

**Lab1:** Familiarization with programming environment

**Tutorial 2:** Variable types and type conversions:

**Lab 2:** Simple computational problems using arithmetic expressions

**Tutorial 3:** Branching and logical expressions:

**Lab 3:** Problems involving if-then-else structures

**Tutorial 4:** Loops, while and for loops:

**Lab 4:** Iterative problems e.g., sum of series

**Tutorial 5:** 1D Arrays: searching, sorting:

**Lab 5:** 1D Array manipulation

**Tutorial 6:** 2D arrays and Strings

**Lab 6:** Matrix problems, String operations

**Tutorial 7:** Functions, call by value:

**Lab 7:** Simple functions

**Tutorial 8 &9:** Numerical methods (Root finding, numerical differentiation, numerical integration):

**Lab 8 and 9:** Programming for solving Numerical methods problems

**Tutorial 10:** Recursion, structure of recursive calls

**Lab 10:** Recursive functions

**Tutorial 11:** Pointers, structures and dynamic memory allocation

**Lab 11:** Pointers and structures

**Tutorial 12:** File handling:

**Lab 12:** File operations

**Laboratory Outcome**

To formulate the algorithms for simple problems

To translate given algorithms to a working and correct program To be able to correct syntax errors as reported by the compilers

To be able to identify and correct logical errors encountered at run time To be able to write iterative as well as recursive programs

To be able to represent data in arrays, strings and structures and manipulate them through a program

To be able to declare pointers of different types and use them in defining self-referential structures.

To be able to create, read and write to and from simple text files.

Code	Subject Name	L	T	P
BEEP 101 for 1 <sup>st</sup> sem & BEEP 201 for 2 <sup>nd</sup> sem	Basic Electrical Engineering Lab	0	0	3

**List of Laboratory Experiments/Demonstrations:**

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3. Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of separately excited dc motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
8. Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
9. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

**Laboratory Outcomes:** The students are expected to

- Get an exposure to common electrical components and their ratings. Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines. Get an exposure to the working of power electronic converters.

Code	Subject Name	L	T	P
BMEP 201	Workshop / Manufacturing Practices	1	0	3

Manufacturing is fundamental to the development of any engineering product. The course on Engineering Workshop Practice is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included.

**Course Outcomes:** At the end of this course, students will demonstrate the ability to

- Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications.
- Selection of a suitable technique for meeting a specific fabrication need.
- Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.
- Introduction to different manufacturing methods in different fields of engineering.
- Practical exposure to different fabrication techniques.
- Creation of simple components using different materials.
- Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

**lecture's & videos: (10 hours)**

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing Methods (3 hours)
2. CNC machining, Additive manufacturing (1 hours)
3. Fitting operations & power tools (1 hours)
4. Electrical & Electronics (1 hours)
5. Carpentry (1 hours)
6. Plastic moulding, glass cutting (1 hours)
7. Metal casting (1 hours)
8. Welding (arc welding & gas welding), brazing (1 hours)

**Workshop Practice: (60 hours)**

1. Machine shop - 10 hours
2. Fitting shop - 8 hours
3. Carpentry - 6 hours
4. Electrical & Electronics - 8 hours
5. Welding shop - 8 hours (Arc welding 4 hrs + gas welding 4 hrs)
6. Casting - 8 hours
7. Smithy - 6 hours
8. Plastic moulding & Glass Cutting - 6 hours

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Code	Subject Name	L	T	P
BMEP 202	Engineering Graphics	1	0	3

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software.

This course is designed to address:

- To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- To prepare you to communicate effectively
- To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

**Course Outcomes:**

- At the end of this course, students will demonstrate the ability to
- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

**Proposed Syllabus**

Traditional Engineering Graphics: Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics: Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling.