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Department of Electronics and Communication Engineering
Bhagat Phool Singh Mahila Vishwavidyalaya,
Khanpur Kalan (Sonepat), Haryana-131305
(A state university established by govt. of Haryana vides Act no. 31 of 2006)
www.bpswomenuniversity.ac.in

Course Structure for B. Tech Second Semester (First Year)										
S. No	**Cat**	**Code**	**Course Title**	**Hrs/Week**			**Total Credits**	**Internal Marks**	**External Marks**	**Total Marks**
				L	**T**	**P**				
1.	BSC	******	Physics*	3	1	0	4	20	80	100
2.	BSC	BSC-104	Mathematics–II (Probability and Statistics)	3	1	0	4	20	80	100
3.	ESC	ESC-101	Basic Electrical Engineering	3	1	0	4	20	80	100
4.	**MC**	**#MCL-120/ #EVS-201**	**#Environmental Science**	**3**	**0**	**0**	**0**	**20**	**80**	**100#**
LAB										
5.	BSC	BSC-101-P	Physics Lab	0	0	2	1	10	40	50
6.	ESC	ESC-102-P	Engineering Graphics & Design	1	0	4	3	20	80	100
7.	ESC	ESC-101-P	Basic Electrical Engineering Lab	0	0	2	1	10	40	50
		Total		**13**	**3**	**8**	**17**	**100**	**400**	**500**

Code	**Subject (*Physics)**
BSC-101	Semi–Conductor Physics
BSC101A	Introduction to Electromagnetic Theory
BSC-101B	Introduction to Mechanics
BSC-101C	Quantum Mechanics For Engineers
BSC-101D	Oscillation, Waves and Optics
BSC-101E	Semiconductor Optoelectronics
BSC-101F	Optics, Optical Fiber, Magnetism and Quantum Mechanics

Note:

1. Minimum passing marks for any subject (Paper) shall be 40% in the external examination and 40% in the aggregate of internal and external examination of the subject.
2. # **Environmental Science# (MCL-120/EVS-201)** is a mandatory noncredit and qualifying course in which the students will be required passing marks in theory. The marks of the same will not be counted in grand total and towards award of degree.

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Semi-Conductor Physics

BSC-101
L T P
3 1 0

Total Credits: 4
Internal Marks: 20
External Marks: 80
Total Marks: 100

Course Objective: The objective of this course is:

- To Impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research, and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Pre-requisite: Basic knowledge of Physics.

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

- Understand free electron gas models in solids.
- Became familiar with Mechanism of semi-conductors and their combination with metals.
- Became familiar with the mechanism of light and semiconductor interaction.
- Appreciate various experiments to measure charge density, resistivity, mobility and I-V characteristics of semiconductors.

Content

Unit – I	**10 Hours**
Electronic materials: Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.	
Unit – II	**10 Hours**
Semiconductors: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.	
Unit – III	**12 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. Measurements: Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility, Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics.	
Unit – IV	**10 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 DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.	
Suggested Text/Reference Books	
1.	Semiconductor Optoelectronics: Physics and Technology, J. Singh, McGraw-Hill Inc. (1995).
2.	Fundamentals of Photonics, B. E. A. Saleh and M. C. Teich, John Wiley & Sons, Inc., (2007).
3.	Semiconductor Devices: Physics and Technology, S. M. Sze, Wiley (2008).
4.	Photonics: Optical Electronics in Modern Communications, A. Yariv and P. Yeh, Oxford University

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	Press, New York (2007).
5.	Semiconductor Optoelectronic Devices, P. Bhattacharya, 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

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Mathematics-II: Probability and Statistics

BSC- 104
L T P
3 1 0

Total Credits: 4
Internal Marks: 20
External Marks:80
Total Marks: 100

Course Objective: The objective of this course is:

- Familiarize the prospective engineers with techniques in basic calculus and linear algebra.
- Equip the students with standard concepts and tools at an intermediate to advanced level of mathematics and applications that they would find useful in their disciplines.

Pre-requisites: Basics of Statistics.

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

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties.
- The basic ideas of statistics including measures of central tendency, correlation, and regression.
- The statistical methods of studying data samples.

Content

Unit – I	**12 Hours**
Basic Probability: Probability spaces, conditional probability, independence, Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables, Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	
Unit – II	**10 Hours**
Continuous Probability Distributions: Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. **Module III: Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.	
Unit – III	**10 Hours**
Basic Statistics: Measures of Central tendency: Moments, skewness, and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. **Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	
Unit – IV	**10 Hours**
Applied Statistics: Test of significance: large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. **Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	

Suggested Text/Reference Books

1.	Advanced Engineering Mathematics, 9th Edition, Erwin Kreyszig, John Wiley & Sons, 2006.
2.	Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003 (Reprint).
3.	A First Course in Probability, S. Ross, 6th Edition, Pearson Education India, 2002.
4.	An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Edition, W. Feller, Wiley, 1968.
5.	A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2010.
6	Higher Engineering Mathematics, Khanna Publishers, B.S. Grewal, 35th Edition, 2000.

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7	Engineering Mathematics (for semester III), Veerarajan T., Tata McGraw-Hill, New Delhi, 2010.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Basic Electrical Engineering

ESC- 101 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks: 80**
Total Marks: 100

Course Objective: The objective of this course is:

- To analyse DC and AC circuits.
- To analyse AC series and parallel circuits.
- To understand fundamental knowledge of electric machines.
- To assimilate elementary knowledge of electric installations.

Pre-requisite: Basic understanding of Physics.

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

- Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
- Identify the applications of network theorems and resonance phenomenon in relevant area.
- Analyze the steady state behavior of single phase and three phase AC electrical circuits.
- Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also, identify the connections of a three-phase transformer.
- Understand the fundamentals of Electrical circuits, Electrical machines, measuring instruments and LT installation.
- Assess the type of electrical machines, instruments and LT switchgear to be used for a particular application.

Content

Unit – I	**10 Hours**
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Mesh and nodal analysis of simple circuits with dc excitation, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star to Delta conversion and vice versa, Time-domain analysis of first-order RL and RC circuits.	
Unit – II	**10 Hours**
AC Circuits: 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 (series and parallel circuits). Three-phase balanced circuits, voltage and current relations in star and delta connections, Measurement of Power and Power Factor using two wattmeter method.	
Unit – III	**12 Hours**
Electrical Machines: Construction and working principle of Transformer, Ideal and practical transformer, phasor diagram and equivalent circuit of transformer, losses in transformers, voltage regulation and efficiency, Autotransformer Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Applications of three phase induction motor, Construction and working of DC machine, Speed control of dc machine.	
Unit – IV	**10 Hours**
Electrical Instruments: Permanent Magnet Moving Coil, Electrodynamometer & Moving Iron type instruments, Induction type Energy meter. **Components of LT Switchgear:** Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing, Elementary calculations for energy consumption, power factor improvement.	
Suggested Text Books	
1.	Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.

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2.	Electrical Engineering Fundamentals, Del Toro, Prentice Hall India, 1989.
3.	Basic Electrical Engineering, D. C. Kulshreshtha, McGraw Hill, 2009.
4.	Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 2011.
5.	Electrical and Electronics Technology, E. Hughes, Pearson, 2010.
6.	Basic Electrical Engineering, Volume 1, B. L. Theraja & A. K. Theraja, S. Chand, 2015
7.	Basic Electrical Engineering, S. K. Sahdev, Pearson, 2017.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Environmental Science

MCL-120/EVS-201 **Total Credits: 3**
L T P **Internal Marks: 20**
3 0 0 **External Marks:80**
Total Marks: 100

Course Objective: The objective of this course is:

- To aware the students about the importance of environment and associated issues.
- To help in acquiring knowledge about the environmental problems and their causes.
- To change the attitude to acquire set of values regarding environmental protection.
- To develop skill and thinking in solving local and global environmental problem.
- To change the mind set for active participation in environmental concern.

Pre-requisite: None

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

- To identify the various kinds of natural resources and appropriate methods for preservation and sustainable development.
- To understand the significance of eco system and biodiversity for maintaining ecological balance.
- To recognize the different types of environmental pollutants and their preventive measures.
- To learn about environmental issues arising due to human population growth and developmental activities.

Content

Unit – I	**10 Hours**
Introduction to environment Studies: Nature of Environmental studies scope and importance concept of sustainable development. **Natural Resource:** Land resources: land degradation, soil erosion and desertification. Forest resources deforestation: causes and impacts of mining and dam building on forests and tribal people Water use and over-exploitation of surface and ground water conflicts over water Energy resources: renewable and non-renewable use of alternate energy sources, case studies.	
Unit – II	**10 Hours**
Ecosystems: Definition, structure and function of an ecosystem, energy flow, food chains. food webs and ecological succession, types of ecosystems, case studies. **Biodiversity Conservation**: Definition, value, genetic, species and ecosystem diversity, Biogeography zones of India, hot spots of biodiversity, India as a mega-biodiversity nation, endangered and endemic species of India, threats and conservation of biodiversity.	
Unit – III	**10 Hours**
Environmental Pollution: Type causes, effects, and controls measures of air water. soil and noise pollution Nuclear hazards. Solid waste and its management, global warming, ozone layer depletion, acid rain and their impacts, pollution case studies. **Disaster management:** Droughts, floods, earthquake, cyclones, tsunami and landslides.	
Unit – IV	**12 Hours**
Environmental policies and practices: Environment Protection Act (1986). Air Prevention & Control of Pollution) water (Prevention and control of pollution Act (1974) Wildlite Protection Act (1972); Forest Conservation Act (1980). **Human Communities and the Environment:** Human population growth: impacts and control. Drug abuse: drugs and their effects. Environmental movement's conservation. **Field work- (Write report on any two activities for internal assessment only).** 1. To explain environment issues of your area and suggest some solution for them.	

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2. Visit to a local polluted site-urban/rural/industrial/agricultural sewage treatment plant. 3. Visit to an area to document environment assets: river/ forest/flora/fauna/herbal park. 4. Segregating of biodegradable domestic solid water and electricity conservation. *The rally, quiz, essay and slogan writing and painting competitions etc. would be organized to aware the students about environmental issues. The campaigns like: paper, water, and electricity conservation. Polyethylene free campus and polyethylene free environment. One student one plant campaign etc. would be initiated. Moreover, students would also be provoked to contribute in Swachh Bharat Mission.	
Suggested Text Books/ References	
1	A Textbook of Environmental Studies, D. K. Asthana and A. Meera.
2	Fundamental Concepts in Environmental Studies, D. D. Mishra.
3	Environmental Studies, S. C. Sharma, M. P. Poonia.
4	Textbook of Environmental Studies for Undergraduate, E. Barucha.
5	Environmental Studies: Third Edition, R. Rajagopalan.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Physics Lab

BSC- 101- P
L T P
0 0 2

Total Credits: 1
Internal Marks: 10
External Marks: 40
Total Marks: 50

Course Objective: The objective of this course is:

- To impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research and break through efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Pre-requisites: Basics of Physics.

Laboratory Outcomes: At the end of the course, students will be able to:

- Students would be able to determine the wavelength of white light by using diffraction grating.
- Students will understand to determine the specific rotation of a cane sugar solution.
- Characterize the semiconductor materials by determining band gap & resistivity using four please method.
- Students will be able to determine capacitance using flashing & Quenching of argon bulb.
- Student learn about V-I characteristics of P-N Diode.

List of Experiments

1.	To find the capacitance of unknown capacitor using flashing and quenching of Argon bulb.
2.	To study the photo conducting cell and hence to verity the inverse square law.
3.	To study the characteristics of a solar cell and to find the fill factor.
4.	To find the value of Planck's constant by using a photo electric cell.
5.	To find the value of Hall Co-efficient of semi-conductor.
6.	To study the V-I characteristics of a P-N diode.
7.	To find the band gap of intrinsic semi-conductor using four probe method.
8.	To convert given galvanometer into an ammeter and voltmeter of given range.
9.	To determine the wavelength of sodium light by Newton's rings experiment.
10.	To find the Specific rotation of sugar solution by using Polarimeter.
11.	To find the refractive of a material of a given prism using spectrometer.
12.	To study rectification properties of a semiconductor.
13.	Study of Characteristics of P-I-N and avalanche photo diode detectors.
14.	To determine the resistivity of a semiconductor by four probe method.
15.	To find the wavelength of various colours of white light with the help of a plane transmission diffracting grating

Note: At least 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed from the above list, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.

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Engineering Graphics & Design (Theory & Lab)

ESC- 102- P
L T P
1 0 4

Total Credits: 3
Internal Marks: 20
External Marks:80
Total Marks: 100

Course Objective: The objective of this course is:

- 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.

Pre-requisites: None

Course Outcomes: At the end of the course, students will be able 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.

Laboratory Outcomes: At the end of the course, students will be able to:

- Fabricate components with their own hands.
- Get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- Produce small devices of their interest, by assembling different components.

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.

Engineering Graphics & Design [10 Lecture Hours]

Manufacturing Processes:

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

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Workshop Practice [60 Hours of Lab.]

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)

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; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen Concurrently in the laboratory)

Content

Unit – I
Module 1: Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales. **Module 2: Orthographic Projections:** Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes.
Unit – II
Module 3: Projections of Regular Solids: Solid Inclined to both the Planes- Auxiliary Views, Sections and Sectional Views of Right Angular Solids - Prism, Cylinder, Pyramid, Cone, Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids. **Module 4: Isometric Projections:** Isometric Projections, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.
Unit – III
Module 5: Overview of Computer Graphics: Computer Graphics, demonstrating knowledge of the theory of CAD software like-The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area, Dialog boxes and windows, Shortcut menus (Button Bars), Different methods of zoom as used in CAD, Select and erase objects. **Module 6: Isometric View in CAD:** Isometric Views of lines, Planes, Simple and compound Solids, CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance, Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.
Unit – IV
Module 7: Annotations, layering & other functions: Applying dimensions to objects, applying

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annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface, Drawing annotation, **Module 8: Computer-aided design (CAD) software:** Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface and wireframe models, Parts editing and two-dimensional documentation of models, Planar projection theory, including sketching of perspective, Dimensioning guidelines, tolerance techniques; dimensioning and scale multi views of dwelling; Creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Introduction to Building Information Modelling (BIM).	
Suggested Text/Reference Books:	
1.	Engineering Drawing, Bhatt N. D., Panchal V.M. & Ingle P.R., (2014), Charotar Publishing House.
2.	Engineering Drawing and Computer Graphics, Shah, M.B. &Rana B.C. (2008), Pearson Education.
3.	Engineering Graphics, Agrawal B. &Agrawal C. M. (2012), TMH Publication.
4.	Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah (2008), Scitech Publishers.
5.	(Corresponding set of) CAD Software Theory and User Manuals

Note: At least 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed on the above activities, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.

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Basic Electrical Engineering Lab

ESC -101- P **Total Credits: 1**
L T P **Internal Marks: 10**
0 0 2 **External Marks: 40**
Total Marks: 50

Course Objective: The objective of this course is:

- To get an exposure to common electrical components and their ratings.
- To understand the DC and AC electrical circuits.
- To analyze various laws and theorems in DC circuits.
- To get the fundamental knowledge of electric machines.

Pre-requisite: Fundamental knowledge of 10+2 Physics and current analysis.

Laboratory Outcomes: At the end of the course, students will be able to:

- Perform experimental work and gain technical knowledge of electrical circuits, Electrical machines and measuring instruments along with safety measures.
- Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
- Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
- Evaluate the performance of transformer and electrical machines under various operating conditions.
- Organize reports based on experiments performed with effective demonstration and analysis of results.

List of Experiments

1.	To demonstrate the various basic safety precautions and use of instruments like voltmeter, ammeter, multi-meter, oscilloscope, Real-life resistors, capacitors and inductors in Electrical Engineering Laboratories.
2.	To verify the KVL and KCL.
3.	To verify the Thevenin's and Norton's Theorems.
4.	To verify the Superposition theorem.
5.	To study frequency response of a series R-L-C circuit and determine resonant frequency and & Q-factor for various values of R-L-C.
6.	To study frequency response of a parallel R-L-C circuit and determine resonant frequency and & Q-factor for various values of R-L-C.
7.	To observe steady state and transient time response of R-L, R-C and R-L-C circuits to a step change in voltage.
8.	To measure the power and power factor using three voltmeter / three ammeter method in a single-phase AC circuit.
9.	To measure the power and power factor for a balanced 3 phase load by two wattmeter method.
10.	To perform the direct load test of a Transformer and plot load current versus (a) terminal voltage (b) efficiency.
11.	To measure iron loss in a single-phase transformer and to find the equivalent circuit parameters by performing open circuit and short circuit.
12.	To study various types of meters such as: ammeter, voltmeter, Wattmeter, Multimeter, Energy Meter.
13.	To demonstrate the cut-set of dc machine (Commutator-brush arrangement), induction machine.
14.	To perform the torque-speed characteristics of a separately excited DC Motor.
15.	To perform the open circuit and short circuit tests of a three phase Induction motor.

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Suggested Text Books	
1.	Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2.	Electrical Engineering Fundamentals, Del Toro, Prentice Hall India, 1989.
3.	Basic Electrical Engineering, D. C. Kulshreshtha, McGraw Hill, 2009.
4.	Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 2011.
5.	Electrical and Electronics Technology, E. Hughes, Pearson, 2010.
6.	Basic Electrical Engineering, Volume 1, B. L. Theraja & A. K. Theraja, S. Chand, 2015.
7.	Basic Electrical Engineering, S. K. Sahdev, Pearson, 2017.
Other Useful Resources: Links to course contents	
1.	Kirchhoff's laws. Virtual lab link: http://vlab.amrita.edu/?sub=3&brch=75&sim=217&cnt=2
2.	Thevenin Theorem. Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=313&cnt=1
3.	RLC series resonance. Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=330&cnt=1
4.	Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load. Virtual lab link: http://vp-dei.vlabs.ac.in/Dreamweaver/measurement.html
5.	Determination of parameters of ac single phase series RLC circuit. Virtual lab link: https://vlab.amrita.edu/?sub=1&brch=75&sim=332&cnt=1

Note: At least 10 experiments are to be performed by students in the semester. Out of which at least eight experiments should be performed from the above list, remaining two experiments may either be performed from the above list or designed and set by the concerned faculty as per the scope of the syllabus.

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Introduction to Electromagnetic Theory

BSC-101A
L T P
3 1 0

Total Credits: 4
Internal Marks: 20
External Marks:80
Total Marks: 100

Course Objective: The objective of this course is:

- To impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Pre-requisite: Fundamental knowledge of Mathematics course with vector calculus.

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

- Understand about Forces in nature and constraints.
- Solve simple mechanics problems related to laws of motion and co-ordination system.
- Derive expression for potential energy, central forces and harmonic oscillator (Damped and Un-damped) along with idea of planetary motion given by Kepler.
- Describe rigid body motion in one dimension to three dimensions with various examples of rigid body motion as well as numerical problem related to rigid body rotation.

Content

Unit – I	**12 Hours**
Electrostatics in Vacuum: 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; energy of a charge distribution and its expression in terms of electric field. **Electrostatics in a Linear Dielectric Medium:** 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 center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.	
Unit – II	**10 Hours**
Magnetostatics: 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. **Magnetostatics in a Linear Magnetic Medium:** Magnetization and associated bound currents; auxiliary magnetic field $\vec{H}$; Boundary conditions on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.	
Unit – III	**10 Hours**
Faraday's Law: Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.	

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Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time-dependent electric field; calculating magnetic field due to changing electric fields in quasi-static approximation.		
Unit – IV		**10 Hours**
Maxwell's Equations: Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields. **Electromagnetic Waves**: The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.		
Suggested Text Books		
1.	Introduction to ectrodynamics, David Griffiths.	
2.	Physics, Halliday and Resnick.	
3.	Electricity, magnetism and light, W. Saslow.	

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Introduction to Mechanics

BSC-101D
L T P
3 1 0

Total Credits: 4
Internal Marks: 20
External Marks:80
Total Marks: 100

Course Objective: The objective of this course is:

- To impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Prerequisites: - Basic knowledge of Electronics.

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

- Understand Forces in nature and constraints. Afterwards they would be able to solve simple mechanics problems related to laws of motion and co-ordination system.
- Derive expression for potential energy, central forces and harmonic oscillator (Damped and Un-damped) along with idea of planetary motion given by Kepler.
- Describe rigid body motion in one dimension to three dimensions with various examples of rigid body motion as well as numerical problem related to rigid body rotation.

Content

Unit – I	**10 Hours**
Transformation of scalars and vectors under Rotation transformation, Forces in Nature, Newton's laws and its completeness in describing particle motion, Form invariance of Newton's Second Law, Solving Newton's equations of motion in polar coordinates, Problems including constraints and friction, Extension to cylindrical and spherical coordinates.	
Unit – II	**12 Hours**
Potential energy function, F = - Grad V, equipotential surfaces and meaning of gradient, 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, Kepler problem, Application: Satellite manoeuvres, Non-inertial frames of reference, Rotating coordinate system: Five-term acceleration formula- Centripetal and Coriolis accelerations, Applications: Weather systems, Foucault pendulum.	
Unit – III	**10 Hours**
Harmonic oscillator, damped harmonic motion – over-damped, critically damped and lightly-damped oscillators, forced oscillations and resonance, Definition and motion of a rigid body in the plane, Rotation in the plane, Kinematics in a coordinate system rotating and translating in the plane, Angular momentum about a point of a rigid body in planar motion, Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion, Examples.	
Unit – IV	**10 Hours**
Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its rate of change and (b)Moment of inertia tensor, Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e. g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.	
Suggested Text Books	

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1.	Engineering Mechanics, 2nd Edition, M K Harbola.
2.	Introduction to Mechanics, M K Verma.
3.	An Introduction to Mechanics, D Kleppner & R Kolenkow.
4.	Principles of Mechanics, J L Synge & B A Griffiths.
5.	Mechanics, J P Den Hartog.
6.	Engineering Mechanics - Dynamics, 7th Edition, J L Meriam.
7.	Mechanical Vibrations, J P Den Hartog.
8.	Theory of Vibrations with Applications, W T Thomson.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Quantum Mechanics for Engineers

BSC-101C
L T P
3 1 0

Total Credits: 4
Internal Marks: 20
External Marks:80
Total Marks: 100

Course Objective:

- To impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Pre-requisite: Mathematics course on differential equations and linear algebra.

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

- Develop an informed appreciation of the paradigm shift already in evidence in technologies behind modern services and products
- Solve one-dimensional problems involving transmission, reflection and tunnelling of quantum probability amplitudes;
- Demonstrate an understanding of the significance of operators and eigenvalue problems in quantum mechanics
- Pursue PG courses, research programs and industrial R & D programs in nanotechnologies
- Pursue simulation and modeling of systems encountered in nanotechnologies having basic knowledge of physics.

Content

Unit – I	**10 Hours**
Wave Nature of Particles and Schrodinger Equation: Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle, Mathematical Preliminaries for quantum mechanics **:** Complex numbers, Linear vector spaces, inner product, operators, eigenvalue problems, Hermitian operators, Hermite polynomials, Legendre's equation, spherical harmonics.	
Unit – II	**08 Hours**
Applying the Schrodinger Equation: Solution of stationary-state Schrodinger equation for one dimensional problem– particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Numerical solution of stationary-state Schrodinger equation for one dimensional problem for different potentials, scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope.	
Unit – III	**12 Hours**
Three-Dimensional Problems of Schrodinger Equation: Particle in three-dimensional box and related examples, Angular momentum operator, Rigid Rotor, Hydrogen atom ground-state, orbitals, interaction with magnetic field, spin, Numerical solution stationary-state radial Schrodinger equation for spherically symmetric potentials. **Introduction to Molecular Bonding:** Particle in double delta-function potential, Molecules (hydrogen molecule, valence bond and molecular orbitals picture), singlet/triplet states, chemical bonding, hybridization.	
Unit – IV	**10 Hours**
Introduction to Solids: Free electron theory of metals, Fermi level, density of states, Application to	

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white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands, Numerical solution for energy in one-dimensional periodic lattice by mixing plane waves.	
Suggested Text Books	
1.	Introduction to Quantum Physics, Eisberg and Resnick.
2.	Mechanics, Daniel Mc Quarrie.

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Oscillations, Waves and Optics

BSC-101D
L T P
3 1 0

Total Credits: 4
Internal Marks: 20
External Marks:80
Total Marks: 100

Course Objective: The objective of this course is:

- To impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Pre-requisite: Mathematics course on Differential equations and Introduction to Electromagnetic theory

Course outcomes: At the end of the course, students will be able to:

- Analyze oscillations and waves mathematically.
- Solve simple problems of geometric optics.
- Predict diffraction and interference patterns.
- Operate small telescopes and record images.
- Different type of laser and lasing action with application of laser in various fields

Content

Unit – I	10 Hours
Simple Harmonic Motion, Damped and Forced Simple Harmonic Oscillator: Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, 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	**12 Hours**
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 eigenfrequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity. **Propagation of Light and Geometric Optics:** Fermat's principle of stationary time and its applications e.g., in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method.	
Unit – III	**10 Hours**
Wave Optics: Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power;	

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Unit – IV		10 Hours
Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.		
Suggested Text Books		
1.	Oscillations, Waves and Optics, Vishal Deoarshi, Jtoti Ahuja.	
2.	Waves and Oscillations, Walter Fox Smith.	
3.	The physics of vibrations and waves, H. J. Pain, Wiley, 2006.	
4.	Optics, E. Hecht, Pearson Education, 2008.	
5.	Optics, A. Ghatak, McGraw Hill Education, 2012.	
6.	Principles of Lasers, O. Svelto, Springer Science & Business Media, 2010.	

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Semiconductor Optoelectronics

BSC-101E **Total Credits: 4**
L T P **Internal Marks: 20**
3 1 0 **External Marks:80**
Total Marks: 100

Course Objective: The objective of this course is:

- To impart technology aspects of applied physics
- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.

Pre-requisite: Basic knowledge of Semiconductor physics

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

- Students will be able to understand the new development, research and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Content

Unit – I	**12 Hours**
Review of semiconductor physics: E-k diagram, Density of states, Occupation probability, Fermi level and quasi-Fermi level (variation by carrier concentration and temperature), p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Carrier transport, generation, and recombination; Semiconductor materials of interest for optoelectronic devices, band gap modification, hetero structures, Light-semiconductor interaction: Rates of optical transitions, joint density of states, condition for optical amplification.	
Unit – II	**10 Hours**
Semiconductor light emitting diodes (LEDs): Rate equations for carrier density, Radiative and non-radiative recombination mechanisms in semiconductors, LED: device structure, materials, characteristics, and figures of merit.	
Unit – III	**10 Hours**
Semiconductor lasers: Review of laser physics, Rate equations for carrier- and photon-density, and their steady state solutions, Laser dynamics, Relaxation oscillations, Input-output characteristics of lasers. Semiconductor laser: structure, materials, device characteristics, and figures of merit; DFB, DBR, and vertical-cavity surface-emitting lasers (VECSEL), Tunable semiconductor lasers.	
Unit – IV	**10 Hours**
Photo detectors: Types of semiconductor photo detectors, P-N junction, PIN, and Avalanche and their structure, materials, working principle, and characteristics, Noise limits on performance; Solar cells. Low-dimensional optoelectronic devices**:** Quantum-well, wire, and dot-based LEDs, lasers, and photo detectors.	
Suggested Text Books	
1.	Optoelectronics: Physics and Technology, J. Singh, Semiconductor McGraw-Hill Inc.
2.	Fundamentals of Photonics, B. E. A. Saleh and M. C. Teich, John Wiley & Sons,
3.	Semiconductor Devices: Physics and Technology, S. M. Sze, Wiley (2008).
4.	Photonics: Optical Electronics in Modern Communications, A. Yariv and P. Yeh, Oxford University Press, New York (2007).
5.	Semiconductor Optoelectronic Devices, P. Bhattacharya, Prentice Hall of India (1997).
Other Useful Resources:	
1.	Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
2.	Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

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Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.

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Optics, Optical Fiber, Magnetism and Quantum Mechanics

BSC-101F **Total Credits: 4**
L T P **Internal Marks: 20**
3 1 0 **External Marks:80**
Total Marks: 100

Course Objective: The objective of this course is:

- To lay foundation of practical application of physics in engineering.
- To apply Basics Physics concepts in a broader sense.
- Students will be able to understand the new development, research and breakthrough efficiency in engineering physics.
- Understand and explain the various physics related problems in engineering field.

Pre-requisite: Basic knowledge of optics and Quantum mechanics.

Course outcomes: At the end of the course, students will be able to:

- Familiar with Bragg's Law and introduced to the principles of lasers, types of lasers and applications.
- Understand various terms related to properties of materials such as, permeability, polarization, etc.
- Analyze basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials. Simple quantum mechanics calculations.

Content

Unit – I	**12 Hours**
Optics: Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications. **Polarization:** Introduction, polarization by reflection, polarization by double refraction, scattering of light, circular and elliptical polarization, optical activity.	
Unit – II	**10 Hours**
Fiber Optics and Lasers: Fiber Optics: Introduction, optical fiber as a dielectric wave guide: total internal reflection, numerical aperture and various fiber parameters, losses associated with optical fibers, step and graded index fibers, application of optical fibers. **Lasers:** Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping, various modes, threshold population inversion, types of lasers: solid state, semiconductor, gas; application of lasers.	
Unit – III	**10 Hours**
Electromagnetism and Magnetic Properties of Materials: Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's Faraday's laws. Maxwell's equations. Polarization, permeability and dielectric constant, polar and non-polar dielectrics, applications of dielectric. Magnetization, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	
Unit – IV	**10 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 1-D box.	
Suggested Text Books	
1.	Vibrations and waves in physics, I. G. Main, Cambridge University Press, 1993.
2.	The physics of vibrations and waves, H. J. Pain, Wiley, 2006.

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

Note: Nine questions will be set in all by the examiners taking two questions from each unit and one question containing short answer type questions from entire syllabus. Students will be required to attempt five questions, selecting one question from each unit. Question No.1 is compulsory which is from entire syllabus.