(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Applied Sciences

M.Sc (Physics)

Vision of the Department:

The department of Applied Sciences is committed to inculcate expertise in the students in the field of basic sciences, technology and personality development so that they can make the world a better place.

Mission of the Department:

M1: Prepare the students' basics strongly to make a mark at global perspective.
M2: Culminate extraordinary analytical, logical and ethical skills to make them industry ready.
M3: Develop a good citizen and a good human being through all round development.

Program Educational Objectives (PEOs):

PEO1Fundamental Knowledge: to attain skills in the fundamental concepts of basic sciences necessary for success in industry or in engineering practices as well as advanced study.
PEO2Specialization: prepare to pursue career choices in all branches of engineering or related interdisciplinary fields that will benefit from a strong background in applied sciences and engineering.
PEO3Design Skills: to imbibe with problem solving skills, laboratory skills, and design skills for technical careers in solving critical problems.

Program Outcomes (POs):

PO1Scientific Knowledge: To employ critical thinking and the scientific method to design not only with respect to science subjects but also in all aspects related to life.
PO2 Understanding and critical thinking: To demonstrate an understanding of major concepts in all disciplines of Science.
PO3 Problem analysis: To analyze the scientific data critically and systematically and the ability to draw the objective conclusions.
PO4 Design/development of solutions: To foster observation skills and drawing logical conclusions from the scientific experiments.
PO5 Conduct investigations of complex problems: To develop scientific temper to propose novel ideas in explaining facts and figures or providing new solution to the problems.
PO6 Scientist and Society: To cultivate rational outlook and analyze the results of experiments and get an awareness of the impact of Science on the environment, society, and other cultures outside the scientific community.

PO7 Environment and sustainability: To imbibe with new ideas for the sustainable developments.

PO8 Ethics and Responsibility: To nurture ethical, social and moral values in personal and social life paving a path to highly cultured and civilized personality.

PO9 Management and projects: Enhancing To acquire the analytical skills in handling scientific instruments, planning and performing in laboratory experiments.

PO10 Individual and Team Work: To apply knowledge and experience to foster personal growth and appreciate the diverse social world in which we live.

PO11 Modern tool usage: To provide technology-oriented skills, tools and ability to develop creative solutions and engage in continuing professional development.

PO12 Life-long learning: To attain the knowledge of subjects in other faculties such as humanities, performing arts, social sciences etc. can have greatly and effectively influence which inspires in evolving new scientific theories and inventions.

Program Specific outcomes (PSOs):

PSO1: To carry out experiments in basic as well as certain advanced areas of physics such as nuclear physics, condensed matter physics, nano science, lasers and electronics

PSO2: To build a scientific temper and to learn the necessary skills to succeed in research or industrial field.

PSO3: To be able to define and resolve new problems in Physics and participate in future development of Physics.

PSO4: To develop strong student competencies in Physics and its applications in a technology--rich, interactive environment

PSO5: Have necessary skills and expertise in field of research and development.

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DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Applied Sciences

M.Sc (Physics)

1. **Duration of Course:**

1.1 The duration of course shall be two academic years consisting of four (4) semesters i.e. two semesters in each year. The duration of each semester will be 18-20 weeks with ninety (90) teaching days.

1.2 The duration of Post-Graduate Diploma course shall be one academic year consisting of two (2) semesters. The duration of each semester will be 18-20 weeks with ninety (90) teaching days.

2. **Maximum period for passing M.Sc. Physics.**

The candidate must pass all the subjects of all the semesters of M.Sc. Physics in four (4) years. If the candidate fails to pass all the subjects of the course within stipulated period, his/her registration will be cancelled.

3. **Eligibility for admission**

A candidate must have passed B.Sc. from any recognized University with 50% marks in aggregate. 5% relaxation in marks shall be given to Schedule Caste/ Schedule Tribe or any rural and under privileged candidates.

4. **Medium of Instructions**

The medium of instruction during the course and examinations shall be Punjabi/Hindi/English.

5. **Examination Schedule, examination fee and examination forms:**

5.1 The examination of Odd Semesters shall ordinarily be held in the month of December and that of Even Semesters in the month of May, or on such other dates as may be fixed by the competent authority.

5.2 The candidates will be required to pay examination fees as prescribed by the University from time to time.

5.3 The Examination Form must reach in the office of the Controller of Examinations as per the schedule notified, from time to time.

5.4 The Examination Forms must be countersigned by the Director/Head of the Department along with the following certificate :--

(i) that he/she has been on the rolls of the University Teaching Department during the academic term preceding the end semester examination;

(ii) that he/she has attended not less than 75% lectures delivered to that class in each paper; and

(iii) That he/she has a good moral character.

5.5 The shortage in the attendance of lectures of the candidate may be condoned by the Vice-Chancellor, on the recommendations of Head of the Department, as per rules.

6. **Re-admission**

In case name of a student is struck off from the rolls due to non-payment of fee or continued absence from classes in any subject for one month and he/she will be re-admitted after payment of re-admission fee as prescribed by the University from time to time. However, the student will be allowed to appear in the end semester examination of that paper (s) only after attending the required lectures/practicals delivered to that paper(s). However, if a student falls short of attendance in all courses offered in a semester he/she shall be required to repeat the semester, along with the next batch of students.

7. **Scheme of Examinations**

The examination in each semester shall be conducted according to the syllabus prescribed for the semester. The end semester examination for each paper shall be of three hours duration.

8. **Minimum pass marks**

The minimum number of marks required to pass in each semester shall be 40% marks in each in Theory and Practical/Laboratory/Seminar/Viva-Voce paper and in Internal Assessment, separately.

9. **Grading of performances**

9.1 Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given hereunder:-

Percentage of marks obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A+	9	Excellent
70.00 – 79.99	A	8	Very Good
60.00 – 69.99	B+	7	Good
50.00 – 59.99	B	6	Average
40.00 – 49.99	C	5	Pass
Less than 40.00	F	0	Fail
Absent	AB	0	Fail

9.2 Grades from ‘O’ to ‘C’ are pass grades.

9.3 A student who fails in any end semester shall be assigned a letter grade ‘F’ and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

9.4 A student who remains absent for any end semester examination shall be assigned a letter grade of ‘AB’ and a corresponding grade point of zero.

9.5 Semester Grade Point Average (SGPA) $= (\sum C_i G_i) / (\sum C_i)$

Where C i = No. of C assigned to ith semester

G i = No. of Grade equivalent point assigned to ith semester.

$$\text{Cumulative Grade Point Average (CGPA)} = \frac{\sum (SGPA_j \times C_j)}{\sum C_j}$$

Where $SGPA_j$ = SGPA score of jth semester

C_j = Total no. of C in the jth semester

9.6 Percentage can be calculated as CGPA *10

10. Declaration of class and Division

The class shall be awarded on the basis of CGPA as follows:

CGPA: ≥7.5 provided that the candidate must have passed all the Semester Examinations in the first available attempt.	First Division with Distinction
CGPA: 6.0 to 7.49	First Division
CGPA: 5.0 to 5.99	Second Division
CGPA: 4.0 to 4.99	Third Division

11. Internal Assessment of failed candidate

The internal assessment award of a candidate who fails in the external examination shall be carried forward to the next Examination, if passed in Internal Assessment.

12. Grace Marks

12.1 The grace marks of 1% of total marks of the semester shall be given to a candidate to his best advantage so as to enable him to pass in one or more written papers, to make up aggregate to pass the examination/paper or for changing the result from FAIL to COMPARTMENT/PASS. If a fraction works out to be half or more, it shall be counted as one mark and fraction less than half shall be ignored.

12.2 If a candidate appears in an examination to clear re-appear/compartment paper, the grace marks of 1% will be given only on the total marks of that particular paper.

13. Re-evaluation

A candidate who is not satisfied with his result may apply to the Examination Branch for re-evaluation in a subject/paper within 15 days of declaration of result along with a fee as prescribed by the university from time to time.

14. Re-checking

A candidate who is not satisfied with his result may apply to the Examination Branch for re-evaluation in a subject/paper within 15 days of declaration of result along with a fee as prescribed by the university from time to time.

15. **Special examination**

A Special Examination will be conducted for those students who are passing out but having re-appear(s) in the last semester and/or in the lower semesters. The special examination will be conducted within one month of the declaration of final semester result. The student shall have to pay prescribed fee for Special Examination.

16. **Re-appear/Supplementary examination**

In case of re-appear examination, the University will adopt even/odd semester examination or open semester system. The student will be eligible to appear in the re-appear papers of odd semester along with the odd semester regular examinations of subsequent batches and re-appear of even semester's paper of the even semester regular examinations in the case of even/odd semester examination. The student will be eligible to appear in the re-appear papers of all semesters (even/odd) along with regular examinations of open semester examinations. Controller of Examination will implement any of the above examination system with the approval of the Vice-Chancellor.

17. **Mercy Chance**

The candidate will be given maximum two chances to appear in the supplementary examinations. After that, mercy chance may be given by the Vice-Chancellor on the recommendations of the Director of the concerned school on payment of a special fee.

18. **Syllabus for re-appear candidates**

A student who obtains re-appear(s) in a subject will be examined from the same syllabus which he/she studied as a regular student.

19. **Promotion Criteria**

19.1 A candidate who joins First Semester of M.Sc. Physics may on completing attendance requirements appear in 1st semester examination. He/she shall be allowed to continue his/her studies in the 2nd Semester evenif he/she does not clear any paper of the 1st semester and on completing attendance requirements may appear in the 2nd Semester examination.

19.2 A candidate shall not be eligible to join 3rd Semester of M.Sc. Physics if he/she has yet to clear more than 50% papers of First and Second Semesters taken together. A candidate who has cleared 50% or more papers of M.Sc. Physics 1st and 2nd Semesters taken together may join 3rd Semester and on completing attendance requirements may take 3rd Semester Examination. He/she shall be allowed to continue his/her studies in the 4th Semester even if he/she does not clear any paper of the 3rd Semester and on completing attendance requirements may appear in 4th Semester examination.

20. **Division Improvement**

A candidate who has passed M.Sc. Physics examination from this University may re-appear for improvement of division in one or more subjects in the succeeding semesters with regular candidates in order to increase the percentage for obtaining higher division. However, final year candidates who have passed an examination of the University may re-appear for improvement of performance under special examination as per rules of the university.

21. **Migration to this University**

21.1 Migration to this Universitywill be allowed only after completion of the 1st year and is applicable only to those students who are eligible to register for 3rd semester.

21.2 Migration shall be allowed after completion of the second semester but before start of the 3rd semester.

21.3 The candidates shall not be allowed to change his/ her discipline of study in the process of migration.

21.4 Migration to an affiliated College /Institute of the University from other recognized universities will be allowed 15 days prior to of the start of the 3rd semester. The following conditions shall be apply:-

i) The candidate should have passed all the courses of the first year of the University from where he/she wants to migrate.

ii) The courses studied by the candidate in first year must be equivalent to the courses offered in this University. Deficiency, if any, should not be of more than two subjects. The candidate would be required to furnish an undertaking that he/she will attend classes and pass these courses (found deficient). The institute and the University where the student is studying and the Institute, to which migration is sought, have no objection to the migration.

iii) There is a vacant seat available in the discipline in the college in which migration is sought.

21.5 Power of Relaxation: Notwithstanding the existing Migration Rules, the Vice-Chancellor, after obtaining an undertaking/affidavit from the candidate, to his satisfaction, to be recorded in writing, shall be authorized to consider the migration for the cases that are not otherwise covered under the above Migration Rules, with the approval of the Chancellor.

22. **Migration to any other University**

22.1 Migration to any other University will be allowed 15 days prior to of the start of the 3rd semester.

22.2 The candidate seeking migration from this University shall be apply for the approval of his migration to the University within 15 working days after passing the 2nd Semester/First Year Examination.

22.3 The Director/Head of the department concerned of the University will issue "No Objection Certificate" after the candidate has paid all the fees due for the remaining period of the full session as well as the annual dues as per rules. In addition to the above, Migration fee as prescribed by the University shall be charged from such candidates.

22.4 If a candidate, on completion of any course, applies for Migration Certificate, the same shall be issued on receipt of fee prescribed for Migration Certificate and on completion of other formalities etc.

23. **Award of Detail Marks Card**

Each candidate of First Year M.Sc. Physics (i.e. Semester-I & Semester-II), Second Year (i.e. Semester-III & Semester-IV) and Third Year (i.e. Semester-V & Semester-VI), on successfully completion of course and passing all the papers of each semester, shall be supplied Detail of Marks Cards indicating CGPA score and Division obtained by him/her in the examination.

24. **Award of Degree**

The degree of Master of Science in Physics in the concerned stream stating the CGPA score and Division will be awarded to the candidate who has successfully completed the course and passed all the papers of all the semesters. The degree will be awarded at the University Convocation. However, a degree in absentia can be issued before the convocation, on completion of required formalities and payment of prescribed fee.

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DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Applied Sciences

Program: M.Sc (Physics)

Semester I

S. No.	Course Code	Course Name	Category	Internal	External	Total	L	T	P	C
1	MSCP-101	Mathematical Methods of Physics	CC	40	60	100	2	2	0	3
2	MSCP-102	Classical Mechanics	CC	40	60	100	3	0	0	3
3	MSCP-103	Electronics-I	CC	40	60	100	3	0	0	3
4	MSCP-104	Electronics-I Lab	CC	40	60	100	0	0	2	1
5	MSCP-105	Classical Electrodynamics	CC	40	60	100	3	0	0	3
Department Elective Courses (Select Any One)										
6	MSCP-106	Statistical Physics	DE	40	60	100	3	0	0	3
7	MSCP-107	Solid State Physics	DE	40	60	100	3	0	0	3
Life Skill Courses										
8	DBEF-101	Foundations of Employability Skills	LSC	40	60	100	1	0	4	3
Total				280	420	700	15	2	6	19

L- Lecture, T- Tutorial, P- Practical, C- Credit, CC- Core Course, DE- Department Elective, LSC- Life Skill Course

Course Code:MSCP-101
Title of the Course: Mathematical Methods of Physics

L	T	P	Credits
2	2	0	3

Course Outcomes:
After completion of this course student will able to:
CO1: Solve Legendre differential equations of various types.
CO2: Describe special functions and their recurrence relations.
CO3: Use complex numbers and variables.
CO4: Explain Polynomials and various methods to evaluate polynomials.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	M	M	W	W	M	M	M
CO3	S	M	M	M	M	W	M	M	M	S	W	W
CO4	M	S	S	S	S	M	W	W	S	S	W	M

Unit	Course Outline	Hour(s)
I	**Gamma and beta functions**: Definition of beta and gamma functions, Relation between beta and gamma functions, Evaluation of integrals using beta & gamma function **Bessel functions:** Definition of Bessel functions of 1st and 2^{nd} kind, Generating function of $J_n(x)$ and their recurrence relations and orthogonality.	**9**
II	**Legendre differential equation**: Solution of Legendre differential equation, Legendre polynomials, Rodrigue's formula, Generating function for Legendre polynomials and recurrence relations, Orthogonality of Legendre polynomials.	**9**
III	**Complex variables:**Elements Complex analysis, Limit and continuity, Cauchy's Riemann equations, Complex integrations, Cauchy's theorem for simply and multiply connected regions, Cauchy's integral formula, Taylor and Laurents series, Poles and singularities, Cauchy's residue theorem.	**9**
IV	**Evaluation of Polynomials:** Horner's method; Root finding; Fixed point iteration, Bisection method, Regulafalsi method, Newton method, Error analysis, System of linear equations. Gauss Seidalmethods,Interpolation and Extrapolation: Lagrange's interpolation, least square fitting; Differentiation and Integration: Difference operators, simpson and trapezoidal rules; Ordinary differential equation: Euler method, Taylor method.	**9**

Total- 36

Text Books:

1. Artken& Weber, Mathematical methods for Physicist, Academic Press- N.Y.
2. E. Kreyszig, 7th Edition, Advanced Engineering Mathematics, New Age International.

Reference Books:

1. J.W. Brown, R.V .Churchill, Complex Variables and Applications, Mc-Graw Hill.
2. A. W. Joshi, Matrices and Tensors in Physics, New Age International.
3. P.K. Chattopadhyay, Mathematical Physics, 1st Ed., New Age International.
4. C. Harper, Introduction to Mathematical Physics, Prentice Hall of India, New Delhi, 2004.
5. M.R. Spiegel, Schaum's Outline of Advanced Mathematics for Engineers and Scientists, 1st Ed., McGraw Hill, 2009.

References Links:

1. https://nptel.ac.in/courses/115103036/#
2. https://swayam.gov.in/nd1_noc20_ma14/preview

Course Code: MSCP-102
Title of the Course: Classical Mechanics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to:
CO1: Have a deep understanding of Newton's laws with the help of Lagrangian formulation and variational Principle.
CO2: Solve the Two-body central force problem along with Symmetry properties of Mechanical systems**.**
CO3: Understand the foundations of chaotic motion.
CO4: To have understanding of Hamiltonian formulation.
CO5: Have understandCanonical transformation and Symmetry properties of Mechanical systems.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	M	M	M	W	M	M	W
CO3	M	S	S	M	M	W	M	M	W	S	W	M
CO4	S	M	S	S	S	M	W	W	W	S	W	W
CO5	S	S	S	M	S	M	M	M	W	M	M	W

Unit	Course Outline	Hour(s)
I	**Lagrangian formulation**: Conservation laws for a system of particles, Constraints and generalized coordinates, Principle of virtual work, D'Alembert principle, Lagrange's equations of motion. Related numerical problems.	**9**
II	**Variational principle**: Hamilton's principle, Calculus of variations, Lagrange's equations from Hamilton principle.Generalized momentum, Cyclic coordinates, Symmetry properties and Conservation theorems. Related numerical problems.	**9**
III	**Hamiltonian formulation**: Legendre transformation, Hamilton's equations of motion, Hamilton's equation from variational principle, Principle of least action. Related numerical problems.	**9**
IV	**Canonical transformation**: The equations of canonical transformation, examples of canonical transformation and harmonic oscillator problem, Poisson brackets and their canonical invariance, Equationsof motion in Poisson bracket formulation, Poisson bracket relations between components of linear and angularmomenta. Hamilton-Jacobi equations for Hamilton principal and characteristic functions. Action-anglevariables. Related numerical problems	**9**
		Total- 36

Text Books:

1. H. Goldstein, C. Poole and J. Fafko, Classical Mechanics, Pearson EducationInc., 2002.
2. K.C. Gupta, Classical Mechanics of Particles and Rigid Bodies, Wiley Eastern, 2006.
3. J.R. Taylor, Classical Mechanics, 1
st Ed., University Science Books, 2005.
4. D. Morin, Introduction to Classical Mechanics, 1st Ed., Cambridge University Press, 2008.
5. R.G. Takwale, and P.S. Puranik, Introduction to Classical Mechanics, Tata McGraw-Hill Education, 1979.

References:

1. Percival and D. Richards, Introduction to Dynamics, Cambridge University press, 1982.
2. Rana and Joag, Classical Mechanics, Tata McGraw-Hill, 1991.
3. Landau and Lifshitz, Mechanics, Butterworth-Heinemann, 1982.
4. J.W. Harald and Muller-Kirsten, Classical Mechanics and Relativity, 1st Ed., World scientific
Publishing Ltd, 2008.
5. D.Strauch, Classical Mechanics - An Introduction, 5th Ed., Springer, 2009.

Reference links:

1. https://nptel.ac.in/courses/122106027/
2. https://nptel.ac.in/courses/115105098/

Course Code: MSCP-103
Title of the Course: Electronics-I

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Have a deep understanding of Semiconductor Devices and their working.
CO2: Understand the analog circuits**.**
CO3: Understand the concept of Feedback in amplifiers and Bias for transistor amplifier.
CO4: To have understanding of Number Systems and logic gates.
CO5: Understand the flip flops, binary systems and switching devices.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	M	M	M	S	M	W	M	M	M	W
CO3	S	M	S	M	S	W	M	M	W	S	W	M
CO4	M	S	S	S	M	M	W	S	M	M	M	W
CO5	S	S	M	S	S	S	M	S	S	M	W	M

Unit	Course Outline	Hour(s)
I	**Semiconductor Devices:** Tunnel diode. SCR, TRIAC, DIAC, UJT.	**7**
II	**Analog Circuits** **Two port network analysis:** Active circuit model's equivalent circuit for BJT, Transconductance model: Common emitter. Common base.Common collector amplifiers.Equivalent circuit for FET.Common source amplifier. Source follower circuit **Power amplifiers:** Operating conditions, Power relations, Non-linear Distortion, Class A power amplifier, Class B Power Amplifier. Push-Pull principle	**9**
III	**Number Systems:** Binary, octal and hexadecimal number systems. Arithmetic operations: Binary fractions, Negative binary numbers, Floating point representation, Binary codes: weighted and non-weighted binary codes, BCD codes, Excess-3 code, Gay codes, binary to Gray code and Gray to binary code conversion, error detecting and error correcting codes. **Logic Gates:** AND, OR, NOT, OE operations: Boolean identities, Demorgan's theorem: Simplification of Boolean functions. NAND, NOR gates. **Combinational logic:**Minterms, Maxterms, K-map(upto 4 variables), POS, SOP forms. Decoders. Code converters, Full adder, Multiple divider circuits.	**11**

IV	**Flip flops:** RS, JK-, D- and T-flip flops set up and hold times, preset and clear operations. **Switching devices:** BJT, FET, CCD, IIL switching devices.Major logic families, Bistable multi-vibrator and Schmitt Trigger circuits.	**9**

Total- 36

Text Books

1. R.L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 9th Ed., Pearson Education, 2009.
2. T.L. Floyd, Electronic devices, 9th Ed., Pearson Education. Ltd., 2013.
3. A.R. Gayakwad, Op-amps and linear integrated circuits, 3rd Ed., Prentice-Hall, Inc., 2000.
4. D.P. Leach, A.P Malvino and G. Saha, Digital Principles and Applications, 7th Ed., 2011.

References

1. W.D. Stanley, Operational amplifiers with linear integrated circuits, 4th Ed., Pearson Education India, 2002.
2. D.D. Givone, Digital Principles and Design, Tata McGraw-Hill, 2002.
3. K. Udaya Kumar, The 8085 Microprocessor: Architecture, Programming and Interfacing, Pearson Education India, 2008.
4. A. Sproul, Understanding the pn Junction Solar Cells, Resources for the Secondary Science Teacher (2003): 13-24**.**

Reference Links:

1. https://nptel.ac.in/courses/115102014/

Course Code: MSCP-104
Title of the Course: Electronics-I Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:
After completion of this course student will able to**:**
CO1: Collect data and revise an experimental procedure iteratively and reflectively.
CO2: Evaluate the process and outcomes of an experiment quantitatively and qualitatively.
CO3: Extend the scope of an investigation whether or not results come out as expected.
CO4: Communicate the process and outcomes of an experiment.
CO5: Conduct an experiment collaboratively and ethically.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	M	S	M	M	W	M	W	W	M	M	M
CO3	S	S	S	M	S	W	M	M	M	S	W	M
CO4	S	S	M	S	M	M	W	M	W	S	M	M
CO5	M	S	S	M	S	S	M	S	M	M	S	W

Experiments
1. To study the characteristics of Tunnel diode.
2. Use of Transistor as a push pull amplifier (Class 'A', 'B' and 'AB').
3. To study characteristics of FET and determine its various parameters.
4. To study the characteristic of PN junction Diode.
5. Verify De-Morgan's law and various combinations of gates using Logic gates circuit.
6. To construct logic gates AND, NOT using NAND gates and verifies their truth tables.
7. To study 2 bit Adder &Subtractor.
8. Study of transistor as CE, CB and CC amplifier.
9. To study JK, MS and D-flip flops.
10. To Study the Half and full adder of binary numbers.

References Links:
https://nptel.ac.in/courses/117103063/

Course Code: MSCP-105
Title of the Course: Classical Electrodynamics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Have a deep understanding of Electrostatics equations.
CO2: Understand the boundary value problems.
CO3: Understand the concept of mutipoles and dielectrics.
CO4: To have understanding of magnetostatics.
CO5: Understand the Time varying fields.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO'S	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	M	M	M	S	M	W	M	M	M	W
CO3	S	M	S	M	S	W	M	M	W	S	W	M
CO4	M	S	S	S	M	M	W	S	M	M	M	W
CO5	S	S	M	S	S	S	M	S	S	M	W	M

Unit	Course Outline	Hour(s)
I	**Electrostatics:** Coulomb's law, Electric field, Evaluation of electric field due to uniformly charged sphereusing Coulomb's law, Differential form of Gauss law, Dirac delta function and its properties, Representationof charge density by Dirac delta function, Equations of electrostatics, Scalar potential and potential due toarbitrary charge distribution, Discontinuities in electric field, Electric potential, Poisson and Laplaceequations, Dirichlet and Neumann boundary conditions, Uniqueness theorem Electrostatic potential energyfor continuous charge distributions, Energy density.	**9**
II	**Boundary value problems in electrostatics:** Boundary value problems in one and two dimensions inCartesian, spherical and cylindrical coordinates. Methods of images, Point charge placed near a groundedsheet and near a grounded conducting sphere.	**9**
III	**Magneto statics:** Continuity equation, Biot-Savart's law, Differential equations of magneto statics andAmpere's law, Vector potential and its calculation, Magnetic moment, Macroscopic equations, Boundaryconditions on B and E, Magnetic scalar potential.	**9**
IV	**Time varying fields:** Faraday's law of electromagnetic induction, Energy in the Magnetic field, Maxwellequations, Displacement current, Electromagnetic potential, Lorentz and Coulomb gauge. Maxwellequations in terms of electromagnetic potentials, Solution of	**9**

	Maxwell equations in Coulomb Gauge andLorentz gauge by Green function	

Total- 36

Recommended Books:

1. Griffiths, D.J., Introduction to Electrodynamics, Dorling Kingsley, (1998).
2. Jackson, J.D., Classical Electrodynamics, Wiley Eastern, (1999).
3. Puri, S.P., Classical Electrodynamics, Tata McGraw Hill, (1999).
4. Jordan, E.C. and Balmain, K.G., Electromagnetic Wave and radiating systems, Prentice Hall of India, (2007)

Links:

https://swayam.gov.in/nd1_noc20_ph08/preview

Course Code: MSCP-106
Title of the Course: Statistical Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Have a deep understanding of the modern aspects of equilibrium and non-equilibrium statistical physics.
CO2: Understand the physical statistics and its relation to information theory along with different types of ensembles.
CO3: Understand the concept of quantum behavior ofBose-Einstein, Fermi-Dirac theories
CO4: Have a basic understanding of the phase transitions,
CO5: To understand the use of linear response theory and kinetic equation approach.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	M	M	W	W	M	M	M
CO3	S	S	S	M	S	W	M	M	S	S	W	M
CO4	S	M	S	S	S	M	W	S	W	S	M	W
CO5	S	S	S	S	S	S	M	S	S	M	S	W

Unit	Course Outline	Hour(s)
I	Review of classical thermodynamics, Thermodynamic description of Phase transitions, Van-der Waals equation of state. Phase space, Ensemble, Liouville'stheorem,Classical Statistical Mechanics; Postulates. Micro canonical ensemble, Entropy of an ideal gas, Gibb's paradox.	**9**
II	Distribution function, Boltzmann transport equations, Boltzmann's H-theorem, Most probable distribution laws, Conservation laws of mass, momentum and energy, The zero-order approximations, Euler's equations, TheNavier Stokes equations.	**9**
III	Canonical ensemble and its thermodynamics, Partition function, Classical ideal gas.Energyfluctuations.Equipartition theorem, Grand canonical ensemble and its thermodynamics, Density fluctuations. Equivalence of canonical and the grand canonical ensembles.Ideal gas in grand canonical ensemble, Postulates of Quantum Statistical Mechanics.	**9**
IV	Fermi Gas: Equation of state of an Ideal Fermi Gas, Degeneracy, Fermi energy at T=0 and at low temperatures. Bose Gas: Equation of state of an Ideal Bose gas, Bose-Einstein condensation, Density	**9**

	matrix, Equation of motion for density matrix, Expectation valve of an operator.	

Total- 36

Text Book:

1. Statistical Mechanics: Kerson Huang, (John Wiley & Sons, 2nd Ed.)

Reference Book:

1. Statistical Mechanics: R.K. Pathria (2nd Ed.), Butterworth Oxford
2. Pathria, R.K., Statistical Mechanics, Butterworth-Heinemann, (1996).
3. Reif, F., Fundamentals of Statistical and Thermal Physics, Waveland, (2008).

Links:

https://swayam.gov.in/nd1_noc20_cy28/preview
https://swayam.gov.in/nd1_noc19_cy32/preview

Course Code: MSCP-107
Title of the Course: Solid State Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Collect data and revise an experimental procedure iteratively and reflectively.
CO2: Evaluate the process and outcomes of an experiment quantitatively and qualitatively.
CO3: Extend the scope of an investigation whether or not results come out as expected.
CO4: Communicate the process and outcomes of an experiment.
CO5: Conduct an experiment collaboratively and ethically.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	M	M	S	M	M	W	M	M	M	M
CO3	S	S	S	M	S	S	M	M	S	S	W	M
CO4	S	S	S	S	M	M	W	W	M	S	M	M
CO5	S	S	S	S	S	S	M	S	M	M	S	M

Unit	Course Outline	Hour(s)
I	Crystalline and amorphous solids.The crystal lattice.Basisvectors.Unitcell.Plane lattices and their symmetries.Three dimensional crystal systems.Millerindices.Inter-planar spacings. Simple crystal structures: FCC, BCC, Nacl, CsCl, Diamond and ZnS structure, HCP structure.	**9**
II	X-ray diffraction by crystals.Lauetheory.Interpretation of Laue equations.Bragg'slaw.Reciprocallattice.Ewaldconstruction.Atomic scattering factor.Experimental methods of x-ray diffraction.	**9**
III	Types of bonding. The van der waals bond. Cohesive energy of inert gas solids.Ionicbond.Cohesive energy and bulk modulas of ionic crystals.The covalent bond.Metallicbond.Vibrations of one-dimensional monoatomic and diatomic lattices.	**9**
IV	Magnetic properties of solids.Diamagnetism, Langevinequation. Quantum theory ofparamagnetism.Curielaw.Hund'srules.Elementary idea of crystal field effects.Ferromagnetism.Curie-Weiss law. Heisenberg exchange interaction. Mean field theory. Antiferromagnetism.Nuclear magnetic resonance.	**9**

Total- 36

Books recommended:

1. F.C.Phillips: An introduction to crystallography (wiley)(3rd edition)
2. Charles A Wert and Robb M Thonson: Physics of Solids
3. J. P. Srivastava: Elements of solid state physics (Prentice Hall India; 2nd edition).
4. Christmaan-solid state physics (academic press)

Links:

https://swayam.gov.in/nd1_noc20_ph10/preview

Course Code: DBEF-101
Title of the Course: Foundations of Employability Skills

L	T	P	Credits
1	0	4	3

The course is designed to achieve superior outcomes of placement, retention and progression of students through 21' century employability skills' training and assessment.

Skills development network shall provide Vocational curricula and e-content for high quality employability and work skills training through an online learning platform

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Applied Sciences

Program: M.Sc (Physics)

Semester II

S. No.	Course Code	Course Name	Category	Internal	External	Total	L	T	P	C
1	MSCP-201	Atomic & Molecular Physics	CC	40	60	100	3	0	0	3
2	MSCP-202	Quantum Mechanics	CC	40	60	100	3	0	0	3
3	MSCP-203	Electronics-II	CC	40	60	100	3	0	0	3
4	MSCP-204	Electronics-II Lab	CC	40	60	100	0	0	2	1
5	MSCP-205	Nuclear & Particle Physics	CC	40	60	100	3	0	0	3
Department Elective Courses (Select Any One)										
6	MSCP-206	Laser Physics	DE	40	60	100	3	0	0	3
7	MSCP-207	Nano Physics	DE	40	60	100	3	0	0	3
Life Skill Courses										
8	DBES-101	EVS	LSC	40	60	100	3	0	2	4
Total				280	420	700	18	0	4	20

L- Lecture, T- Tutorial, P- Practical, C- Credit, CC- Core Course , DE- Department Elective, LSC- Life Skill Course, EVS- Environmental Studies

Course Code: MSCP-201
Title of the Course: Atomic and Molecular Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Have a deep understanding of current research in Atomic and Molecular physics.
CO2: Understand the spectroscopy of the multi-electron atoms and diatomic molecules.
CO3: Understand the concept of quantum behavior of atoms in external electric and magnetic fields.
CO4: To have understanding of Spectra of one and two valance electron systems.
CO5: To understand the Raman and Electronic Spectroscopy and Rotational and Vibrational Spectroscopy.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	M	M	S	W	M	W	M	M	M	M
CO3	S	S	S	M	S	M	M	M	W	S	W	W
CO4	S	S	S	S	M	M	W	W	M	S	M	M
CO5	S	S	M	S	S	S	M	S	W	M	S	W

Unit	Course Outline	Hour(s)
I	**Spectra of one and two valance electron systems:** Quantum states of electron in an atom, Electron Spin, Vector model for one and two valance electron, Spin orbit interaction and fine structure of hydrogen, relativistic corrections in energy levels for hydrogen atoms, Lamb shift, Hyperfine Structure and isotope effects, Spectroscopic notations for L-S and J-J couplings, Spectra of alkali and alkaline atoms, L-S and J-J coupling for two electron system	**11**
II	**Effects of external fields on atom:** The Zeeman Effect, Normal and Anomalous Zeeman effect, Paschen-Back effect, Stark effect.	**7**
III	**Microwave and Infra-Red Spectroscopy:** Types of molecules, Rotational spectra of diatomic molecules as a rigid and non-rigid rotator (Microwave region spectroscopy), Diatomic vibrating rotator, vibration-rotation spectrum (Infrared region spectroscopy).	**9**
IV	**Raman and Electronic Spectroscopy:** Quantum and classical theories of Raman Effect, Pure rotational Raman spectra for linear and polyatomic molecules, Vibration Raman	**9**

	spectra, Structure determination from Raman and infra-red spectroscopy, Electronic structure of diatomic molecule, Electronic spectra of diatomic molecules, Born Oppenheimer Approximation-The Franck-Condon principle, Electron spin resonance, Nuclear magnetic resonance.	

Total- 36

Text Books:

1. Introduction to Atomic Spectra: H.E. White-Auckland Mc Graw Hill
2. Fundamentals of Molecular spectroscopy: C.N. Banwell and E. M. McCASH, 4th Edition, Mc GrawHill(2017).

Reference Books:

1. Introduction to Molecular Spectroscopy: G.M. Barrow-Tokyo Mc Graw Hill.
2. Physics of atoms and molecules: B. H. Bransden and C. J. Joachan Pearson

Reference Links:

1. https://nptel.ac.in/courses/115101003/
2. https://www.classcentral.com/course/swayam-atomic-and-molecular-physics-9893

Course Code: MSCP-202
Title of the Course: Quantum Mechanics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Have a deep understanding of the Importance of Motion in a Central Potential.
CO2: Understand the linear vector spaces.
CO3: Understand the concept of Application of Application of Symmetry Principles.
CO4: To have understanding of Time Dependent Perturbation Theory.
CO5: To understand the Angular momentum.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	M	M	W	W	M	M	W
CO3	M	S	S	M	S	W	M	M	M	S	W	M
CO4	S	S	M	S	M	M	W	W	W	W	M	W
CO5	S	S	S	S	S	S	M	S	M	M	S	M

Unit	Course Outline	Hour(s)
I	**Linear vector spaces:** State vectors, linear independent and linear dependent vectors, Orthonormality,Hilbert spaces **Operators:** Commutator algebra, Hermitian, unitary and projection operators and their properties. Unitarytransformation, Dirac Bra and Ket Notation: Matrix representations of bras and ket's and operators;Continuous basis, Change of basis-Representation theory. Coordinate and momentum representations,Postulates of quantum mechanics, Generalized uncertainty principle; time-energy uncertainty principle.Schrodinger, Heisenberg & Interaction pictures	**9**
II	**Angular momentum:** Eigen values, Matrix representations of J2, Jz, J , J ; Spin: Pauli matrices and their + -properties, Spin wave functions for two spin-½ system, Addition of spin and orbital momentum, Addition oftwo angular momenta: Clebsch-Gordon coefficients and their properties, derivation of C.G. coefficients for½+½ and ½+1.	**9**
III	**Linear Harmonic Oscillator:** Solution of Simple harmonic oscillator; Vibrational spectra of diatomicmolecule; anisotropic three dimensional oscillators in Cartesian coordinates, Isotropic three dimensionaloscillator in spherical coordinates. Matrix mechanical treatment of linear harmonic oscillator: Energy Eigenvalues and Eigen vectors of SHO, Matrix representation of creation and annihilation operators, Zero-pointenergy.	**9**

IV	**Symmetry Principles:** Introduction of Symmetry and conservation laws, Space time translation and rotations.Conservation of linear momentum, energy and angular momentum. Symmetry and Degeneracy, spaceinversion and parity. Time reversal invariance	**9**

Total- 36

Text Books:

1. Quantum Mechanics: Concepts and applications by NouredineZettili. Approved oard Of Stu

Reference Books:

1. Quantum Mechanics: V.K. Thankappan, New Age International Publications.
2. Quantum Mechanics: P.M. Mathews and K. Venkatesan, Tata-McGraw Publications.
3. Quantum Mechanics: L. I. Schiff (Int. Student Ed.), McGraw Hill Co. Ltd.
4. Quantum Mechanics: W. Greiner, Springer Verlag Pub., Germany.
5. Modern Quantum Mechanics: J. J. Sakurai, Addison Wesley Publication.
6. Introduction to Quantum Mechanics by David Griffiths, Pearson Publication.
7. Quantum Mechanics: M.P. Khanna, Har-Anand Publication, Delhi.

Links:

1. https://swayam.gov.in/nd2_arp19_ap83/preview
2. https://swayam.gov.in/nd1_noc20_ph05/preview

Course Code: MSCP-203
Title of the Course: Electronics-II

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Have a deep understanding basic knowledge of linear amplifiers and their working.
CO2: Understand the Feedback and circuit requirements for oscillator.
CO3: Understand the concept of Operational amplifiers.
CO4: To have understanding of properties and applications of Comparator.
CO5: Understand the knowledge of the Voltage regulators.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	M	M	M	S	M	W	M	M	M	W
CO3	S	M	S	M	S	W	M	M	W	S	W	M
CO4	M	S	S	S	M	M	W	S	M	M	M	W
CO5	S	S	M	S	S	S	M	S	S	M	W	M

Unit	Course Outline	Hour(s)
I	**Modulation & Communication:** Amplitude Modulation, generation of AM waves, Demodulation of AM waves. Frequency modulation, Digital communication: basic idea about (delta modulation, Pulse Code Modulation and Pulse Width Modulation).	**9**
II	**Operational amplifiers:** Ideal operational amplifier. Inverting and non-inverting amplifiers.Differentialamplifiers.CMMR.Internal circuit of operational amplifier.Examples of practical operational amplifier.Operational amplifier characteristics.DC and AC characteristics, slew rate.	**9**
III	**Operational amplifier applications:** Instrumentation amplifier. AC amplifier. V to I and I to V converters. Precision diode circuits. Sample and hold circuits. Log and antilog amplifiers.Differentiatorandintegrator.Analog computation.	**9**
IV	**Comparator and applications:** Multivibrators using Op amplifier, Astable Multivibrator using Opamplifier (square wave generator), Triangular wave generator, Sine wave generator. **Voltage regulators:** series Op. Amp. Regulator, IC regulators and 723 general purpose regulators. **Features of Timer 555**: Monostable Multivibrator,	**9**

	AstableMultivibrator, IC 555 Timer as Schmitt Trigger.	

Total- 36

Text Books:

1. Electronic Fundamentals and Applications: J.D. Ryder, Prentice Hall of India (5^{th} Ed.), N. Delhi.
2. Linear Integrated Circuit: D. Roy Choudury and Shail Jain, Wiley Eastern, New Delhi

References

1. W.D. Stanley, Operational amplifiers with linear integrated circuits, 4th Ed., Pearson Education India, 2002.
2. D.D. Givone, Digital Principles and Design, Tata McGraw-Hill, 2002.
3. K. Udaya Kumar, The 8085 Microprocessor: Architecture, Programming and Interfacing, Pearson Education India, 2008.
4. A. Sproul, Understanding the pn Junction Solar Cells, Resources for the Secondary Science Teacher (2003): 13-24**.**

Reference Links:

https://nptel.ac.in/courses/115102014/

Course Code: MSCP-204
Title of the Course: Electronics-II Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:
After completion of this course student will able to**:**
CO1: Collect data and revise an experimental procedure iteratively and reflectively.
CO2: Evaluate the process and outcomes of an experiment quantitatively and qualitatively.
CO3: Extend the scope of an investigation whether or not results come out as expected.
CO4: Communicate the process and outcomes of an experiment.
CO5: Conduct an experiment collaboratively and ethically.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	M	S	M	M	W	M	W	W	M	M	M
CO3	S	S	S	M	S	W	M	M	M	S	W	M
CO4	S	S	M	S	M	M	W	M	W	S	M	M
CO5	M	S	S	M	S	S	M	S	M	M	S	W

Experiments
1. Operational amplifier (OP Amp) as integrator & differentiator.
2. Study of Clipping & Clamping circuits.
3. To study Digital to Analog Converter.
4. To study Analog to Digital Converter.
5. To study the basic operational amplifier
6. To study the multivibrators using IC-555.
7. To study the various counters
8. To study various Encoders and Decoders.
9. To study the left and right shift registers and ring counters.
10. To study the operation of multiplexer and demultiplexer circuits.

References Links:
https://nptel.ac.in/courses/117103063/

Course Code: MSCP-205
Title of the Course: Nuclear and Particle Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Understand nuclear physics and nuclear interactions.
CO2: Have knowledge of nuclear physics for newer applications.
CO3: Be familiar with the nuclear decays
CO4: Various concepts of Nuclear Models and their applications
CO5: Have a deep understanding of Nuclear Interactions and nuclear reactions.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	W	M	W	W	M	M	M
CO3	S	S	M	M	M	M	M	M	M	S	S	S
CO4	S	M	S	S	S	M	W	W	S	S	M	M
CO5	S	S	M	S	M	S	M	S	W	M	S	S

Unit	Course Outline	Hour(s)
I	**General properties of nuclei:** Introduction, parity and isospin of nuclei, muonic atoms and electron scattering, charge form factor. Magnetic dipole moment electric quadrupole moment and nuclear shape.	**9**
II	**Two-nucleon problem and nuclear forces:** Deuteron ground state, excited states, two-nucleon scattering, n-p scattering, partial wave analysis, phase-shift, scattering length, p-p scattering (qualitative discussion), charge symmetry and charge independence of nuclear forces. Exchange nature of nuclear forces, elementary discussion on Yukawa's theory.	**9**
III	**Nuclear models :** Need for nuclear models, Fermi gas model, spherical shell model	**9**
IV	**Nuclear Reactions:** Types of nuclear reactions, Basic concept of reaction cross-sections, Conservation laws, Direct and compound nuclear-reactions, Nuclear scattering, Breit Wigner one level formula, Resonance scattering, Optical model (qualitative idea).	**9**

Total- 36

Text Books
1. K.S. Krane, Introducing Nuclear Physics, Wiley India, 2008.
2. R.R. Roy and B.P. Nigam, Nuclear Physics: Theory & Experiments, New Age International, 2005.

3. S.S.M. Wong, Introductory Nuclear Physics, 2nd Ed., Wiley VCH, 2004.
4. C.A. Bertulani, Nuclear Physics in a Nutshell, 1st Ed., Princeton University Press, 2007.
5. D. Griffiths, Introduction to Elementary Particles, 2nd Ed., Academic Press, 2008.

References

1. B.L. Cohen, Concept of Nuclear Physics, McGraw-Hill, 2003.
2. B. Martin, Nuclear & Particle Physics: An Introduction, Willey, 2006.
3. H.S. Hans, Nuclear Physics: Experimental and Theoretical, 2nd Ed., New Academic Science Ltd., 2010.
4. K. Heyde, Basic Ideas and Concepts in Nuclear Physics, 2nd Ed., Overseas Press, India, 2005.
5. I. Kaplan, Nuclear Physics, Addison Wesley, (Indian Ed., from Narosa Publishing House, New Delhi), 2002.

Reference Links:

1. https://nptel.ac.in/courses/115104043/
2. https://nptel.ac.in/courses/115103101/

Course Code: MSCP-206
Title of the Course: Laser Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Understand the Einstein Coefficients and Light Amplification.
CO2: Have knowledge of the Basics of Lasers and applications.
CO3: Be familiar with the Types of Lasers.
CO4: Understand Concepts of spectroscopy.
CO5: Have a deep understanding of UV-visible molecular absorption spectroscopy.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	S	M	W	W	M	M	M
CO3	S	S	S	M	S	S	M	M	S	S	W	W
CO4	S	M	S	S	S	M	W	W	S	S	M	S
CO5	M	S	M	S	S	S	M	S	W	M	S	M

Unit	Course Outline	Hour(s)
I	**Introductory Concepts:** Absorption, Spontaneous and stimulated emission, Properties of laser light.Optical and electrical pumping, Three level and four level lasers.	**9**
II	**Types of Lasers and Applications** Ruby lasers, Nd: YAG laser, He-Ne laser, CO2 laser, N2 laser, Excimer laser, Dye lasers,Chemical lasers, Semiconductor lasers.	**9**
III	Concepts of spectroscopy, Process of Absorption, Emission and Scattering, Dispersing devices and detectors: Dispersion and resolution of a prism and a grating spectrometer, Single and double monochromators, Photomultiplier tube, Charge coupled detectors (CCD).	**9**
IV	UV-visible molecular absorption spectroscopy, Molecular luminescence spectroscopy, Infrared Spectroscopy: Instrumentation and typical applications of infrared spectroscopy, Raman Spectroscopy: Instrumentation, Applications of Raman spectroscopy.	**9**

Total- 36

Reference Books :
1. Laser Theory and Applications: K. Thyagarajan and A.K. Ghatak
2. Principles of Lasers : O. Svelto.
3. Laser Spectroscopy and Instrumentation : W. Demtroder.
4. Laser Material Processing : William M. Steen

5. Modern Spectroscopy, J. M. Hollas
6. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E.M. Mc Cash,
7. Advances in Laser spectroscopy: Edited by F.T.Arecchi
8. Laser Applications: Monte Ross

Links:

1. https://swayam.gov.in/nd1_noc20_cy17/preview
2. https://swayam.gov.in/nd1_noc20_cy04/preview

Course Code: MSCP-207
Title of the Course: Nano Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Understand a clear concept of the Nanoscience and Nanotechnology related principles and application.
CO2: Have knowledge of the various approaches for the synthesis and fabrication of nanomaterials, nanostructures and nanoscale devices.
CO3: Be familiar with the basics of the quantum nanostructures
CO4: Understand the structure of broad view of the emerging applications of nanotechnology and nano-electronic devices
CO5: Have a deep understanding of carbon nanostructures and carbon nanotubes.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	S	W	M	W	W	M	M	M
CO3	M	S	S	M	M	W	M	M	S	S	W	S
CO4	S	M	M	S	S	M	W	W	S	S	M	M
CO5	S	S	S	S	M	S	M	S	M	M	S	W

Unit	Course Outline	Hour(s)
I	**Introduction and Synthesis** Free electron theory and its features, Idea of band structure of metals, insulators and semiconductors. Effect of crystal size on density of states and band gap, Examples of nanomaterials. Top-down and bottom-up approaches, Physical and chemical methods for the synthesis of nanomaterials with examples.	**9**
II	**General Characterization Techniques** Determination of particle size, study of texture and microstructure, Increase in x-ray diffraction peaks of nanoparticles, shift in photoluminescence peaks, variation in Raman spectra of nanomaterials, photoemission and X-ray spectroscopy, magnetic resonance, microscopy: transmission electron microscopy, scanning probe microscopy.	**9**
III	**Quantum Nanostructures** Introduction to quantum wells wires and dots**;** preparation using lithography; Size and dimensionality effects: size effects, conduction	**9**

	electrons and dimensionality, potential wells, partial confinement, properties dependent on density of states, surface passivation and core/shell nanoparticles, Nanostructured semiconductors and films, single electron tunneling; Application: Infrared detectors, Quantum dot Lasers.	
IV	**Carbon Nanostructures** Carbon molecules: nature of carbon bond; new carbon structures; Carbon clusters: small carbon clusters, structure of C60, alkali doped C60; Application of carbon nanotubes: field emission and shielding, computers, fuel cells, chemical sensors, catalysis.	**9**

Total- 36

Text Books:

1. T. Pradeep, A Textbook of Nanoscience and Nanotechnology, Tata McGraw Hill Education, 2012.
2. G. Cao, Y. Wang, Nanostructures and Nanomaterials: Synthesis, Properties

Course Code: DBES-101
Title of the Course: EVS

L	T	P	Credits
3	0	2	4

Course Outcomes:
After undergoing this course student will be able to:
CO1: Articulate the interdisciplinary context of environmental issues.
CO2: Identify and justify key stakeholders in humanities and social sciences that need to be a part of sustainable solutions.
CO3: Formulate an action plan for sustainable alternatives that integrate science, humanist, and social perspectives.
CO4: Students will be able to explain why chemistry is an integral activity for addressing social, economic, and environmental problems.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	W	S	S	W	W	S	M	S	M
CO2	S	S	M	M	S	M	M	W	W	S	M	S
CO3	S	M	S	M	S	W	S	M	S	W	S	S
CO4	S	S	M	W	S	S	W	W	S	M	S	M

Unit	Course Outline	Hour(s)
I	**The Multidisciplinary Nature of Environmental Studies** Definition, scope and importance Need for public awareness. **Natural Resources** Renewable and Non-renewable Resources: • Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. (d) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.	**10**

II	**Ecosystems** • Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the ecosystem **Biodiversity and Its Conservation** • Introduction, definition: genetic, species and ecosystem diversity. • Biodiversity at global, National and local levels.	**10**
III	**Environmental Pollution** • Definition • Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards • Solid waste management: Causes, effects and control measures of urban and industrial wastes. • Role of an individual in prevention of pollution. **Social Issues and the Environment** • From unsustainable to sustainable development. • Water conservation, rain water harvesting, watershed management. • Environmental ethics: Issues and possible solutions. • Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. • Consumerism and waste products. • Environment Protection Act. • Air (Prevention and Control of Pollution) Act. • Water (Prevention and Control of Pollution) Act. • Wildlife Protection Act. • Forest Conservation Act.	**10**
IV	**Human Population and the Environment** • Population growth, variation among nations. • Population explosion—Family Welfare Programme. • Environment and human health. • Human rights. • Value education. • HIV/AIDS. • Women and Child Welfare. • Role of Information Technology in environment and human health. • Case Studies. **Field Work** • Visit to a local area to document environmental assets—	**15**

	river/forest/grassland/hill/mountain. • Visit to a local polluted site—Urban/Rural/Industrial/Agricultural. • Study of common plants, insects, birds. • Study of simple ecosystems—pond, river, hill slopes, etc. • (Field work equal to 5 lecture hours	

Total- 45

Reference Books –

1. "Environmental Science" by Miller T G.
2. "Introduction to Environmental Engineering and Science" by Gilbert M Masters.
3. "The Biodiversity of India" by BharuchaErach.
4. "Essentials of Ecology" by Townsend C and Michael Begon.
5. https://nptel.ac.in/courses/122102006/
6. https://swayam.gov.in/nd2_cec19_bt03/preview
7. https://www.pdfdrive.com/environmental-science-e12033451.html

U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Applied Sciences

Program: M.Sc (Physics)

Semester III

S. No.	Course Code	Course Name	Category	Internal	External	Total	L	T	P	C
1	MSCP-301	Condensed Matter Physics	CC	40	60	100	3	0	0	3
2	MSCP-302	Advanced Physics Lab	CC	40	60	100	0	0	2	1
3	MSCP-303	Seminar	CC	40	60	100	0	0	4	2
Department Elective Courses (Select Any One)										
4	MSCP-304	Microprocessor	DE	40	60	100	3	0	0	3
5	MSCP-305	Radio Physics	DE	40	60	100	3	0	0	3
Life Skill Courses										
6	DBEI-301 (SDN)	Employability Skills Intermediate	LSC	40	60	100	1	0	4	3
Total				200	300	500	7	0	10	12

L- Lecture, T- Tutorial, P- Practical, C- Credit, CC- Core Course, DE- Department Elective, LSC- Life Skill Course

Course Code: MSCP-301
Title of the Course: Condensed Matter Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Understand Lattice Dynamics and Thermal Properties.
CO2: Have knowledge of the concepts of Elastic constants and constraints.
CO3: Be familiar with the Dielectric Properties of Materials and Transport Theory.
CO4: Various concepts of Energy Band Theory.
CO5: Have a deep understanding of Transport Theory, Electronic transport from classical kinetic theory.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	M	W	M	W	S	M	M	W
CO3	S	M	S	M	S	W	M	M	W	S	W	W
CO4	S	S	S	S	S	M	W	W	M	S	M	S
CO5	S	S	S	S	S	S	M	S	M	M	S	M

Unit	Course Outline	Hour(s)
I	**Diffraction methods, Lattice vibrations, Free electrons:** Diffraction methods, Scattered wave amplitude,Reciprocal lattice, Brillouin zones, Structure factor, Quasi Crystals, Form factor and Debye Waller factor,Bonding of solids, Lattice vibrations of mono-atomic and diatomic linear lattices, IR absorption, Neutronscattering, Free electron gas in 1-D and 3-D. Heat capacity of metals, Thermal effective mass, Drudemodelof electrical conductivity, Wiedman-Franz law, Hall effect.	**11**
II	**Semiconductor Physics:** Nearly free electron model, Bloch functions, Kronig-penny model, Numberof orbital's in a band, Metals and insulators.	**7**
III	**Semiconductors and Fermi-surfaces in Metals:** Band gap, properties of holes, Effectivemass of electrons (m*), m* in semiconductors, Band structure of Si-Ge and GaAs, Intrinsic carrierconcentration, Intrinsic and extrinsic conductivity, Thermoelectric Effects, Semimetals, Different zoneschemes.	**9**
IV	**Lattice defects**: Point defects, diffusion, Ionic conductivity, Photoconductivity, Concepts of traps, Colourcenters, Shear strength in	**9**

	single crystals, Dislocations and its types, Burger's vector, Stress field ofdislocations. Low angle and large angle grain boundaries. Dislocation multiplication by Frank-Read source andstrength of alloys	

Total- 36

Text Books:

1. Introduction to Solid State Physics; C. Kittel (7th Ed.), Wiley Eastern, N. Delhi, 1995.

Reference Books:

1. Solid State Physics, S. O. Pillai (9th Ed.), New Age International Pvt Ltd, 2020.
2. Solid State Physics; A.J. Dekker (2nd Ed.), McMillan India Ltd.

Reference Links:

1. https://nptel.ac.in/courses/115106061/
2. https://nptel.ac.in/courses/115105099/

Course Code: MSCP-302
Title of the Course: Advanced Physics Lab

L	T	P	Credits
0	0	2	1

Course Outcomes:
After completion of this course student will able to**:**
CO1: Collect data and revise an experimental procedure iteratively and reflectively.
CO2: Evaluate the process and outcomes of an experiment quantitatively and qualitatively.
CO3: Extend the scope of an investigation whether or not results come out as expected.
CO4: Communicate the process and outcomes of an experiment.
CO5: Conduct an experiment collaboratively and ethically.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	S	S	S	M	M	W	M	W	S	M	M	M
CO3	S	S	S	S	M	W	M	M	W	S	W	M
CO4	M	S	M	S	S	M	S	W	S	S	M	W
CO5	S	S	S	M	S	S	M	S	S	M	S	S

Experiments
1. To study B-H curve.
2. To study the characteristics of solar cell.
3. Study of standard deviation using G-M counter.
4. To find Dead time of a GM Tube
5. Find the band gap energy of the given semi-conductor sample by four probe method.
6. Write a program to subtract two hexadecimal numbers.
7. Write a program to add two hexadecimal numbers.
8. Write a program to perform division of two 8 bit numbers.
9. Write a program to perform multiplication of two 8 bit numbers.
10. To study Amplitude Modulation and De-Modulation.

Reference Links:
1. https://nptel.ac.in/courses/115105121/
2. https://swayam.gov.in/nd1_noc20_ph09/preview
3. https://nptel.ac.in/courses/115105121/
4. https://swayam.gov.in/nd1_noc20_ph04/preview

Course Code: MSCP-303
Title of the Course: Seminar

L	T	P	Credits
0	0	4	2

Course Outcomes:

At the end of the course, the student will be able to

CO1: Collect useful information from the literature on the particular topic chosen by student

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	W	M	W	S	M	S	M	S

Course Code: MSCP-304
Title of the Course: Microprocessor

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Explain 8085 microprocessor as central device connected to memory and I/O devices.
CO2: Describe basics of microprocessor, microprocessor architecture and programming.
CO3: Explain & perform experiments based on interfacing microprocessor with memory and various I/O (Input/Output) devices.
CO4: Analyze, design, and simulate various programming based on microprocessor and its peripheral.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	M	S	M	S	S	W	W	S	S	M
CO2	S	S	S	M	S	M	M	M	W	M	M	W
CO3	S	M	S	M	S	M	W	M	M	M	M	M
CO4	S	M	M	S	M	M	W	W	S	S	M	W

Unit	Course Outline	Hour(s)
I	**Introduction:** Introduction to Microprocessors, microcomputer and single chip microcomputer, Components of Microprocessor: Registers, ALU and control & timing, CPU, I/O devices, clock, memory, bussed architecture, tri-state logic, address bus, data bus and control bus.	**9**
II	**Architecture of 8085 Microprocessor:** Microprocessor Architecture, Pin Functions, De-multiplexing of Buses Memory and I/O operation , Generation of Control Signals, Instruction Cycle.	**9**
III	**Instruction Set :** Assembly Language Programming Basics, Classification of Instructions, 8085 Instruction Set, Instruction and data Formats, Addressing Modes	**9**
IV	**Assembly Language Programming:** Looping, counting and indexing using data transfer, arithmetic, logical and branch instructions. Stack & Subroutines, Time Delay routines, Code Conversion, BCD Arithmetic and 16-Bit Data operations. **Interfacing of Memory & I/O with 8085 microprocessor:** Memory mapped I/O and I/O mapped I/O. Address decoding, interfacing of memory chips with 8085. Interfacing of I/O devices with 8085	**9**

Total- 36

Reference Books:

1. Gaonkar R. S., “Microprocessor Architecture, Programming and Applications”.
2. Sunil Mathur, “Microprocessor 8085 and Its Interfacing”, PHI Learning Pvt. Ltd.
3. Hall D. V., “Microprocessor and Interfacing-Programming and Hardware”, Tata McGraw-Hill Publishing Company Limited.
4. Muhammad Ali Mazidi, ARM Assembly Language Programming & Architecture.
5. Short K. L., “Microprocessors and Programmed Logic”, Pearson Education.

Course Code: MSCP-305
Title of the Course: Radio Physics

L	T	P	Credits
3	0	0	3

Course Outcomes:
After completion of this course student will able to**:**
CO1: Know about various experimental techniques microwave measurements.
CO2: Know about various instruments include optical devices, modulators etc.
CO3: Understand the analysis of networks and systems.
CO4: Understand the wave guide and network control systems.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	M	M	S	M	W	W	S	S	M
CO2	M	S	S	M	S	W	M	W	W	M	M	W
CO3	S	S	S	M	S	W	M	M	M	S	W	M
CO4	S	M	M	S	M	M	W	W	S	S	M	W

Unit	Course Outline	Hour(s)
I	**Microwave Devices:** Klystron, magnetrons, Travelling wave tubes, Gunn, Impatt, transistors, GaAs-InP FET, HEMT **Optical Devices:** Laser and Laser resonator, LEDs, Photodiodes, APD, Photo conductor	**9**
II	**Microwave measurements** (Frequency, power, impedance). **Optical modulator:** Electro optics modulation (amplitude and phase). **Optical coupler:** Coupling of light from one fiber to other with the use of evanescent wave.	**9**
III	**Integrated optics:** basic idea. **Analysis of networks and systems:** Sample data system. Z-Transform, Fourier and Laplace transforms.	**9**
IV	**Wave Guide and transmission networks:** Wave guides coaxial, rectangular and cylindrical; resonators; filters; couplers; branching networks. Antennas-dipole, array; reflectors, steering strip, micro strip and coplanar structure. **Feed back control systems:** Feedback system, stability, performance criteria, servo systems, automatic control principle.	**9**
		Total- 36

Reference Books:
1. P. Bhattacharya - Semiconductor opto electronics devices.
2. R E Collin - Foundations of Microwave engineering.
3. S.Y.Liao – Microwave Devices on circuits.
4. J. Ryder – Networks, Lines and Field.
5. A. Papoulis – Signal Analysis 6. Electronic and Radio Engineering – F. E Terman.

Course Code: DBEI-301 (SDN)
Title of the Course: Employability Skills Intermediate

L	T	P	Credits
1	0	4	3

The course is designed to achieve superior outcomes of placement, retention and progression of students through 21' century employability skills' training and assessment.

Skills development network shall provide Vocational curricula and e-content for high quality employability and work skills training through an online learning platform

(U/S 2(f) and 12B of the UGC Act1956, NAAC Accredited)

DESH BHAGAT UNIVERSITY, MANDI GOBINDGARH

Faculty of Engineering and Applied Sciences

Department of Applied Sciences

Program: M.Sc (Physics)

Semester IV

S. No	Course Code	Course Name	Category	Internal	External	Total	L	T	P	C
1	MSCP-401	Research Methodology	CC	40	60	100	2	0	0	2
2	MSCP-402	Major Project	CC	100	200	300	0	0	48	24
Life Skill Courses										
3	HVP-201C*	Human Value and Professional Ethics	LSC	40	60	100	2	0	0	2
Total				180	320	500	4	0	48	28

L- Lecture, T- Tutorial, P- Practical, C- Credit, CC- Core Course, LSC- Life Skill Course

Course Code: MSCP-401
Title of the Course: Research Methodology

L	T	P	Credits
2	0	0	2

Course Outcomes:
At the end of the course, the student will be able to
CO1: Organize and conduct research (advanced project) in a more appropriate manner.
CO2: Write a research report and thesis.
CO3: Write a research proposal (grants).
CO4: Prepare a project proposal (to undertake a project).

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	M	S	M	M	M	W	S	S	M	S
CO2	M	S	S	W	M	M	S	W	M	S	W	M
CO3	S	M	M	S	M	W	S	M	M	W	S	W
CO4	S	S	S	S	M	S	M	S	M	M	W	W

Unit	Course Outline	Hour(s)
I	Foundations of Research: Meaning, Objectives. Concept of theory, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable.ResearchProcess Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic&Importance	**9**
II	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent &Dependentvariables. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches. Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.	**9**

III	Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of thesample Practical considerations in sampling andsamplesize. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.	**9**
IV	Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, PlagiarismandSelf-Plagiarism. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detectionofPlagiarism	**9**

Total- 36

Books Recommended:-

1. BusinessResearchMethods–DonaldCooper&PamelaSchindler,TMGH,9thedition
2. Business Research Methods – Alan Bryman& Emma Bell, Oxford UniversityPress.
3. Research Methodology –C.R.Kothari
4. Select references from theInternet

Links:

1. https://swayam.gov.in/nd2_cec20_hs17/preview#:~:text=The%20present%20course%20intends%20to,sociology%2C%20social%20work%2C%20etc.
2. https://swayam.gov.in/nd1_noc19_ge21/preview

Course Code: MSCP-402
Title of the Course: Major Project

L	T	P	Credits
0	0	48	24

Course Outcomes:
On completion of this course, the students will be able to:
CO1: Understand project characteristics and various stages of a project.
CO2: Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.

CO/PO Mapping (S-Strong Correlation, M- Medium Correlation, W-Weak Correlation)												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	M	S	M	M	M	W	S	S	M	S
CO2	M	S	S	W	M	M	S	W	M	S	W	M

Course Code: HVP-201C*
Title of the Course: Human Value and Professional Ethics

L	T	P	Credits
2	0	0	2

Course Outcomes:
On completion of this course, the students will be able to:
CO1: Become sensitive towards human values.
CO2: Understand commitment and responsibility.
CO3: Gain the ability to bring harmony to the society they live
CO4: Progress from discrimination to commitment
CO5: Develop the ability to face difficult situations in life boldly and resolve them confidently

CO/PO mapping (S/M/W indicates strength of correlation) S- Strong , M-Medium , W- Weak												
CO's	Program Outcome (PO's)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	S	M	S	M	M	M	W	S	S	M	S
CO2	M	S	S	W	M	M	S	W	M	S	W	M
CO3	S	M	M	S	M	W	S	M	M	W	S	W
CO4	S	S	S	S	M	S	M	S	M	M	W	W
CO5	M	S	S	W	M	M	S	W	M	S	W	M

Unit	Course Outline	Hour(s)
I	**Introduction - Need, Basic Guidelines and Content:**Understanding the need, basic guidelines, content and process for Value Education. Self Exploration–what is it? - Its content and process; „Natural Acceptance" and Experiential Validation- as the mechanism for selfexploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations	**10**
II	**Process for Value Education**: Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living inHarmony at various levels **Understanding Harmony in the Human Being** - Understanding human being as a co-existence of the sentient „I" and the material „Body" Understanding the needs of Self („I") and „Body" - Sukh and Suvidha Understanding the Body as an instrument of „I" (I being the doer, seer and	**10**

	enjoyer)	
III	**Harmony in Myself! :** Understanding the characteristics and activities of „I‟ and harmony in „I‟ . Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya- practice exercises and case studies will be taken up in practice sessions. **Understanding Harmony in the Family and Society-** Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship	**10**

Total- 30

Recommended Books

1. Engineering Ethics (Includes Human Values)" by Govindarajan M.
2. "Professional Ethics and Human Values" by Govindarajan M.
3. "Human Values" by A N Tripathi.
4. "Human Values and Professional Ethics" by Jayshree Suresh and B S Raghavan.