

P. D. E. A's
Prof. Ramkrishna More Arts, Commerce and Science
College (Autonomous), Akurdi Pune-411044



Affiliated to

Savitribai Phule Pune University [SPPU]



B. Voc (Software Development)

(Three Years B. Sc. and Four Years B. Sc. Honors Program)

Choice Based Credit System [CBCS]

Under

Autonomy and NEP-2024 Pattern

From Academic Year
2026-2027

Syllabus

Third Year Graduate (T.Y. B. Voc)
Software Development

Board of Studies in B. Voc (Software Development)

Rules and Regulations

1. National Credit Framework (NCrF): For creditisation and integration of all higher education qualifications leading to a certificate/ diploma/ degree with multiple entry and exit options, college will refer to National Credit Framework (NCrF) which encompasses the qualification frameworks for higher education, vocational and skill education and school education, namely National Higher Education Qualification Framework (NHEQF), National Skills Qualification Framework (NSQF) and National School Education Qualification Framework (NSEQF) respectively.

2. Structure of Four years multidisciplinary UG Programme and Five Years Integrated Multidisciplinary Master's Degree Programmes with Multiple Entry and Exit Options at Different Levels:

- (i) Students will have the flexibility to enter four years multidisciplinary Under Graduate Programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.
- (ii) Students will get a Certificate after a One year programme (minimum 40 Credits), a Diploma after two years (minimum 80 Credits), a Bachelor's degree after three years (minimum 120 Credits), and a Bachelor's degree with Research or Honours after Four years (minimum 160 Credits).

3. Qualification Type and Credit Requirements of Four Years Multidisciplinary Degree Programme with Multiple Entry and Exit Options

- (i) Details of qualifications, minimum credit requirements, exit credit courses, year and semester are as under:

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Years Bachelor's degree	120	132	6	3
6.0	Bachelor's degree Honour's with Major	160	176	8	4
	Bachelor's degree Honour's with Major	160	176	8	4
7.0	Master's Degree	200	220	10	5
8.0	Ph. D.	----	-----	-----	----

- (ii) An exit 6-credit bridge course(s) lasting two months, including at least 6-credit job specific internship/apprenticeship that will help the graduates acquire job-ready competencies required to enter the workforce will be an additional requirement for the award of the undergraduate Certificate/ Diploma/ three year Bachelor's Degree.
- (iii) On exit, the students will have the option to re-enter the programme in the college, or in a different higher education institution. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records.

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- (iv) Eligibility for admission to the fourth year of four-year **Honours with Research Degree Programmes** as per UGC guidelines: Minimum CGPA of 7.5 or minimum 75% at three-year degree.
 - (v) PG curriculum, as illustrated below, have flexibility a) One-year Post-Graduate Diploma (PGD), b) Two year Post-graduate Programme and c) 5 Years Master's degree programmes with multiple Entry and Exit options at different levels.
 - (a) Post-Graduate Diploma (PGD):** Programme duration- One year (2 semesters) after any bachelor's degree, min. 40 credits
 - (i) UGC: 1-Year (2 semesters) Post-Graduate Diploma (PGD) after 3-years Bachelor's degree: Level 6.0
 - (ii) UGC: 1-Year (2 semesters) PGD after 4 years Bachelor's degree (Honors/ Research): Level 6.5
 - (b) Master's Degree:**
 - (i) UGC: 2-Years (four semesters) Master's Degree after obtaining a 3-years Bachelor's degree, Minimum 40 credits/year, second year devoted entirely to research, PG – 2nd year: Level 6.5
 - OR**
 - (i) 1-Year (two semesters) Master's Degree after obtaining a 4-year Bachelor's degree (Honours/Research): Minimum 40 credits: Level 6.5
 - (c) Level 8 represents Ph. D. Research Degree.
 - (d) A 5-year Integrated Bachelor's and Master's programme shall have a minimum of 220 credits.
 - (e) Master's and doctoral programmes, while providing rigorous research-based specialization, should also provide opportunities for multidisciplinary work, in academia, government, research institutions, and industry.

4. Lateral Entry/ Re-entry at higher Levels after exit from lower levels of four years multidisciplinary UG degree programme:

- (i) The credit points earned and accumulated shall be used to determine the eligibility for taking admission to various programs at multiple levels, subject to fulfilment of the broad principles laid down under NCERF. Students who leave with a Certification, Diploma, or a Basic Bachelor's Degree will be eligible to re-enter the programme at the exit level to complete or progress to the next level through lateral entry mode. Depending upon the academic and physical facilities available, the State Universities/ Autonomous Colleges (Higher Education Institutions or HEI) may earmark specific seats/ intake for lateral entry into the second year/ third year/ fourth year of a four years multidisciplinary UG degree programme as approved by Professional Standard Setting Bodies (PSSB/Govt. of Maharashtra/ statutory council of affiliating University plus any consequential vacancies caused by exits to an ongoing programme (four-year Degree Programme and Integrated Master's or second year Master's). Lateral entry or Re-entry is open to those students if he/she has either –
- (a) successfully completed the first year/second year/third year of the particular four years multidisciplinary degree programme in any ABC registered HEI with valid credits in ABC and re-entering into the second year/third year/fourth year, respectively of the same four years degree programme of any ABC registered HEI, within stipulated/ permissible period of years as decided by Statutory Councils of that HEI
- OR**
- (b) Already successfully completed a multidisciplinary four-year first-degree programme and is desirous of and academically capable of pursuing another multidisciplinary four years first-degree programme in an allied subject.

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- (ii) A student will be allowed to enter/re-enter only at the odd semester. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records. However, in terms of the admission eligibility requirements, the student shall belong to the same faculty/ discipline in terms of Major Subject i.e., the Major subject of his earlier Programme and the Major subject of the new Programme for which he is seeking admission must be from the same faculty/discipline. Reservation for lateral entry will be executed as per the Government of Maharashtra norms.

5. Distribution of Credits across Multidisciplinary Four Years Degree Programme:

- (i) Four-year multidisciplinary degree programme with Honours/ Specialization Degree will have Internship and Core /Major Courses with a minimum of 22 credits per sem. in the Fourth Year.
- (ii) Four-year multidisciplinary degree programme with Research will have Research Projects, Seminars, Dissertations and Internships with a minimum of 22 credits per Sem. in the Fourth Year.
- (iii) Students shall select a 'Major or Core Subject/ Discipline' and a '**Minor Subject/Discipline**' from the lists of various **Subject Combinations and Options provided the Colleges**. In general, for the four years multidisciplinary bachelor's degree programme, the distribution of credits will be as follows:
- (a) Disciplinary/interdisciplinary Major/ Core Subject (minimum of 68 credits)- Mandatory and Elective Courses
 - (b) Disciplinary/interdisciplinary Minor Subject (maximum of 22 credits)
 - (c) Skill based/Vocational studies corresponding to the Major/ Core Subject (8 credits)
 - (d) Field projects/internship/apprenticeship/community engagement and service corresponding to the Major/ Core Subject (14-22 credits) with a maximum of six credits per Semester
 - (e) Generic/ Open Electives through Baskets of Elective Courses (12 credits),
 - (f) Ability Enhancement Courses including Languages, Literature and Environmental Studies (12 credits),
 - (g) In-built modules on the Indian Knowledge System (IKS) in Major/ Core Subject at Level 4.5 – 2 credits
 - (h) Value-based Education, Life Skills and Professional Ethics: Co-curricular Courses such as Sports and Culture, NSS/NCC and Fine/ Applied/Visual Arts (8 credits).

Student can earn some credits (SEC/VSC/GE/OE) in the form of online from-

- (i) The National Skills Qualifications Framework (NSQF) organizes qualifications for Vocational and Skill Courses in a series of 8 levels based on professional knowledge, professional skills, core skills and responsibilities, in the increasing order of complexity and competency.
- (ii) University Grants Commission (Credit Framework For Online Learning Courses through Study Webs of Active-Learning for Young Aspiring Minds) Regulations, 2021, **permits up to 40 per cent of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) platform.**

6. Examination and Assessment Process:

- (i) The basic principle of the credit framework is that credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.
- (ii) Exit options are provided with certification, diploma and basic Bachelor's degrees to the students at the end of the second, fourth and sixth semesters of a four years multidisciplinary degree programme. Students will receive a Bachelor's degree with Honours/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.

(iii) For the smooth success of four-year multidisciplinary degree programme with multiple entry and exit systems, the examination mode will be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination modes. This is in line with the UGC Report on 'Evaluation Reforms in Higher Educational Institutions (2019)'.

(iv) Evaluation of each students in each course will be done as follows

- Each theory or practical course will be of 2 credits = 50 mark
- Internal evaluation 30% weightage (15 mark)
- External evaluation 70% weightage (35 marks)
- Students should secure 40% marks in each type of evaluation for successful completion of a course (student should secure at least 6 marks in internal and 14 marks in external evaluation).

(v) Evaluation Pattern.

- Internal evaluation** - Two written test, each of 20 marks will be conducted i. e. two tests on two modules. 1st assignment after completing 6 weeks of teaching and 2nd on completion of 13th week of teaching. Question paper should be designed so that evaluation of CO, PO, PSO can be performed. 10 marks out of 15 will be assigned from these written tests. Remaining 5 marks will be assigned from other types of evaluation such as seminars, orals, poster presentation, open book challenging tests, surprise test, objective test on whole syllabus of the course (at least 40 questions of objective type must be designed), etc. for 5 marks at least two different types technique must be utilized.
- External Evaluation** - External evaluation will be done at the end of semester. For theory, 35 marks written examination will be conducted and time of examination will be 2-hours.

7. Declaration of Results:

- Declaration of result is based on the Semester Grade Point Average (SGPA) earned towards the end of each semester or the Cumulative Grade Point Average (CGPA) earned at the completion of all eight semesters of the programme and the corresponding overall alpha-sign or letter grades as given in Table 2. If some candidates exit at the completion of the first, second or third year of the four years Undergraduate Programmes, with Certificate, Diploma or Basic Degree, respectively, then the results of successful candidates at the end of the second, fourth or sixth semesters shall also be classified on the basis of the CGPA obtained in the two, four, six or eight semesters, respectively. Successful candidates at the end of the tenth semester of the integrated Master's Degree Programmes shall also be classified on the basis of CGPA obtained in the ten semesters of the Programmes. Likewise, the successful candidates of one year or two semesters Master's Degree Programme are also classified on the basis of the CGPA of two semesters of the Master's Degree Programme.

Table-2: Grades on degree certificate/mark sheet will be assigned to the students as per the following table

Semester GPA/ Program CGPA Semester/Program	% of Marks	Alpha-Sign / Letter Grade Result
9.00-10.00	90-100	O (outstanding)
8.00 - <9.00	80.00 – <90.00	A+ (Excellent)
7.00 - <8.00	70.00-<80.00	A (Very Good)
6.00 - <7.00	60.00-<70.00	B+ (Good)
5.50 - <6.00	55.00-<60.00	B (Above Average)
5.00 - <5.50	50.00-<55.00	C (Average)
4.00 - <5.00	40.00-<50.00	P (Pass)
Below 4.00	< 40	F (Fail)
Ab	-----	Absent

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- (ii) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. For non-credit courses 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

8. Award of Major and Minor Degree:

- (i) A student pursuing four-year multidisciplinary UG programme will be awarded an appropriate Honours/ Research degree in Major/ Core Subject on completion of VIII Semester with the minimum of 176 credits if he secures in that Subject at least 50% of the total credits for that programme. He shall thus study the specific number of Mandatory Core Courses, Core Electives, Vocational and Skill Courses and Field projects/ Internships connected to Core Subjects in eight semesters so as to cover at least 50% of the total credits.
- (ii) In case of Research Degree, a student shall pursue research project and write dissertation in that Major in the VII and VIII semesters.

On the basis of above rules and regulations under NEP-2020 following course frame work is adopted by the Prof. Ramkrishna More Arts, Commerce and Science College, Akurdi, Pune-411044 for the completing of four years honours degree in Major and Minor subjects.

9. Distribution of Credits across Four Years Degree Programmes:

In general, for the four years' bachelor's degree programme, the distribution of credits will be as follows:

(a) Major (Core) Subject comprising Mandatory and Elective Courses:

- Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses offered in all Four years;
- 2 credit course on Major Specific IKS shall be included under Major;
- Elective courses of Major will be offered in the third and/or final year.
- Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects connected to Major first to fourth year.

(b) Minor Subject: 18-20 Credits

- The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether.
- The credits of Minor subjects shall be completed in the first three years of UG Programme.

(c) Generic/ Open Elective Courses (OE): 10-12 credits

- It is to be offered in I and/or II year
- Faculty-wise baskets of OE shall be prepared by University/ Autonomous Colleges.
- OE is to be chosen compulsorily from faculty other than that of the Major.

(d) Vocational and Skill Enhancement Courses (VSEC): 14-16 credits

Vocational Skill Courses (VSC): 8-10 credits, including Hands on Training corresponding to the Major and/or Minor Subject:

- To be offered in first to three years;
- Wherever applicable vocational courses will include skills based on advanced laboratory practicals of Major

Skill Enhancement Courses (SEC): 06 credits

- To be offered in I and II year;
- To be selected from the basket of Skill Courses approved by University/ Autonomous Colleges

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): 14 Credits

• **AEC: 08 credits**

- To be offered in I and II year
- English: 04 Credits

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- iii. Modern Indian Language: 04 credits
 - iv. To be offered from the Basket approved by the College;
The focus for both languages should be on linguistic and communication skills.

o IKS: 2 Credits

- i. To be offered in I Year
- ii. Courses on IKS to be selected from the basket of IKS courses approved by the Colleges

o VEC: 04 Credits

- i. To be offered in I year
- ii. Value Education Courses (VEC) Environmental Science Education (Compulsory), Understanding India, and Digital and Technological Solutions.

(f) Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

o Internship/Apprenticeship corresponding to the Major (Core) Subject: 8 Credits

o Field Projects/Community Engagement and Service corresponding to the Major (Core) Subject: minimum 4-6 credits

To be offered in II, and III years of UG Degree Programmes.

o Co-curricular Courses (CC) such as Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts: 8 credits. To be offered in I and/or II year

o Research Projects: 12 credits

To be offered in the final year for 4-year Honours with Research UG Degree

The UGC Regulations, 2021 permit up to 40% of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the SWAYAM platform and/or other State Level Common Platforms which can be developed in due course with the participation of different Universities/ HEIs.

Abbreviations: Generic/ Open Electives: **GE/OE**; Vocational Skill and Skill Enhancement Courses: **VSEC**; Vocational Skill Courses: **VSC**; Skill Enhancement Courses: **SEC**; Ability Enhancement Courses: **AEC**; Indian Knowledge System: **IKS**; Value Education Courses: **VEC**; **OJT**: On Job Training; Internship/ Apprenticeship; Field projects: **FP**; Community engagement and service: **CEP**; Co-curricular Courses: **CC**; Research Methodology-**RM**; Research Project: **RP** Note: The Credit Distribution Table given above is illustrative only. The Universities/ Autonomous Colleges may suitably modify within the broader framework of credit distribution across six verticals.

Definitions:

1. One semester = 15 weeks

2. 1-credit theory = 15 hours i.e. for 1 credit, 1 hour per week teaching is to be performed.

15 hours of 1-credit are splinted as 12 hours actual teaching + 3 hours Tutorial (practice problem solving sessions, repeated discussion on difficult topics, discussion on student's difficulties, questions discussion and internal evaluation)

3. 1-credit practical = 30 hours. Thus, 1 credit practical = 2 contact hours in laboratory per week. 30 hours splinted as 24 hours actual table work and 6 hours for journal competition, oral on each practical and other internal evaluation.

4. Each theory course of any type (major, minor, VSC, VEC, OE/GE, VEC, SEC, CC, etc.) **is of 2 credits.**

a. Theory per semester: Contact hours = 24 teaching + 6 tutorials (problem solving sessions, repeated discussion on difficult topics, difficult solution, questions discussion and internal evaluation)

b. Each course will be of two modules, One module = 15 hours

c. Each module may consist of one or more than one chapter.

5. Each practical course of any course is of 2 credits = 60 hours per semester

- a. Minimum 12 laboratory sessions will be conducted in one semester.
- b. Each laboratory sessions will be of 4 hour.

Revised Credit Framework / Structure for NEP-2020; CBCS Pattern-2024 with two Major at FY
To be Implemented from Academic Year 2024-25

Sem	Subject-1				Subject-2	Subject-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
Certificate													
I	SDMAT-111 SDMAT-112 SDMAP-113				ESMAT-111 ESMAT-112 ESMAP-113	0	2 Credit From Basket	SDSEP-111	GIKST-111	HIAET-111 / MAAET-111	VEAET-111	0	22
II	SDMAT-121 SDMAT-122 SDMAP-123				ESMAT-121 ESMAT-122 ESMAP-123	0	2 Credit From Basket	SDSEP-121	0	HIAET-121 / MAAET-121	VEAET-121	CCPEP-121	22
Diploma													
Sem	Credits Related to Major				Subject-2	Subject-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
	Major Core	Major Elective	VSC	FP / CEP / OJT									
III	SDMAT-231 SDMAT-232 SDMAP-233	0	SDVST-231	SDFPP-231	ESMAT-231 ESMAP-232	0	2 Credit From Basket	0	SDIKT-231	ENAET-231	0	CCHRT-231	22
IV	SDMAT-241 SDMAT-242 SDMAP-243	0	SDVSP-241	SDCEP-241	ESMAT-241 ESMAP-242	0	2 Credit From Basket	SDSEP-241	0	ENAET-231	0	CCCST-241	22
Three years Graduation Degree													
V	SDMAT-351 SDMAT-352 SDMAT-353 SDMAT-354 SDMAP-355 SDMAP-356	SDMET-351A SDMET-352A SDMEP-353A Or SDMET-351B SDMET-352B SDMEP-353B	SDVSP-351	SDFPP-351	0	0	0	0	0	0	0	0	22
VI	SDMAT-361 SDMAT-362 SDMAT-363 SDMAT-364 SDMAP-365 SDMAP-366	SDMET-361A SDMEP-362A Or SDMET-361B SDMEP-362B	SDVSP-361	SDOJP-361	0	0	0	0	0	0	0	0	22

Codes, Type of Course, Titles of the Paper and Credits

T. Y. B. Voc (Software Development) Syllabus

CBCS Semester Pattern

Under Autonomy and NEP-2024 Pattern

To Be Implemented From

Academic Year 2026-2027

**Courses Offered by B. Voc. (Software Development)
at Third Year of Graduation**

Sem.	Course code	Type of Course	Title of the paper	Credits
Semester-V				
V	Major Course			
	SDMAT-351	B. Voc. (Software Development) theory paper-09	Python Programming	2
	SDMAT-352	B. Voc. (Software Development) theory paper-10	Go programming	2
	SDMAT-353	B. Voc. (Software Development) theory paper-11	Cloud Computing	2
	SDMAT-354	B. Voc. (Software Development) theory paper-12	Internet Of Things	2
	SDMAP-355	B. Voc. (Software Development) practical paper-5	Lab course on Python	2
	SDMAP-356	B. Voc. (Software Development) practical paper-6	Lab course on Go	2
	Major Elective Courses			
	SDMET-351A	Elective B. Voc. (Software Development) theory paper-1-A	Node.js	2
	SDMET-352A	Elective B. Voc. (Software Development) theory paper-2-A	Kotlin	2
	SDMEP-353A	Elective B. Voc. (Software Development) practical paper-1-A	Node.js & Kotlin Lab	2
	SDMET-351B	Elective B. Voc. (Software Development) theory paper-1-B	Web Analytics and SEO	2
	SDMET-352B	Elective B. Voc. (Software Development) theory paper-2-B	E-Commerce	2
	SDMEP-353B	Elective B. Voc. (Software Development) practical paper-1-B	Web Analytics Lab	2
	Vocational Skill Course			
	SDVSP-351	Vocational B. Voc. (Software Development) Practical-II	Hosting and Deployment of Websites	2
	Research Project			

	SDRPP-351	B. Voc. (Software Development) Re- search Project-I	Research Project	2
Semester – VI				
VI	Major Course			
	SDMAT-361	B. Voc. (Software Development) theory paper-13	Mobile Web Development	2
	SDMAT-362	B. Voc. (Software Development) theory paper-14	Operating System & Shell Scripting	2
	SDMAT-363	B. Voc. (Software Development) theory paper-15	Web Application Testing and Debugging	2
	SDMAT-364	B. Voc. (Software Development) theory paper-16	Blockchain	2
	SDMAP-365	B. Voc. (Software Development) theory paper-7	Operating System Lab	2
	SDMAP-366	B. Voc. (Software Development) practical paper-8	Lab on Mobile Web Development	2
	Major Elective Courses			
	SDMET-361A	Elective B. Voc. (Software Development) theory paper-2-A	Angular Development	2
	SDMET-361B	Elective B. Voc. (Software Development) theory paper-2-B	Dart	2
	SDMEP-362A	Elective B. Voc. (Software Development) practical paper-2-A	Angular Development Practical	2
	SDMEP-362B	Elective B. Voc. (Software Development) practical paper-2-B	Dart Practical	2
	Vocational Skill Course			
	SDVST-361	Vocational B. Voc. (Software Development) Theory-II	Authentication and Authorization Mechanisms	2
	On Job Training			
	SDOJP-361	B. Voc. (Software Development) OJT	OJT	4

Program Outcomes: B. Voc (Software Development)

- PO-1:** Ability of judicious mix of skills relating to a profession and appropriate content of General Education.
- PO-2:** Ability about adequate knowledge and skills for employment and entrepreneurship.
- PO-3:** Career opportunities in programming, web development and software development.
- PO-4:** Ability to write computer code in a logical, structured, and organized manner.
- PO-5:** Ability to learn Communication Skills and sharpen business acumen to help succeed in today's complex workplaces.
- PO-6:** Enhance employability of the graduates and meet industry requirements.
- PO-7:** Ability to establish themselves as effective professionals by solving real problems through use of computer knowledge
- PO-8:** Ability to develop professional skill that prepares them for immediate employment and for lifelong learning in advanced area of software and related fields.
- PO-9:** Ability to deliver a quality product for business success
- PO-10:** Ability to communicate effectively with wide range of audiences.
- PO-11:** Ability to Design, implement and evaluate a computer base system, process, component or program to meet desired needs.

PROGRAM SPECIFIC OUTCOMES:

- PSO1:** Ability to apply knowledge to work in a team as well as to lead team.
- PSO2:** Ability to write effective project reports in the context of changing technologies.
- PSO3:** An Ability to analyze the local and global impact on computing, on individuals, organization and society
- PSO4:** An ability to innovate new ideas and solution to existing problems.

Semester-V, Major, Theory Paper-09

SDMAT-351: Python Programming

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Python Language	6
	Language Components	6
II	Functions and Modules	6
	Objects and Classes	2
	I/O and Error Handling in Python	4

Module-1

[12L+3T]

Chapter-1: Introduction to Python Language

(6 L)

The Python Programming Language, History, features, Applications, Installing Python, Running Simple Python programs. Basics of Python – Variables, Constants, Identifiers, Reserved words, Lines and indentation, Multi-line statements, Comments, Input/output functions, Operations (assignment, arithmetic, relational, logical, bitwise), Command line arguments, Standard data types, Strings, Escape characters, String formatting, Built-in String methods.

Ref-1: Chapter-2,3,4,5 pp 23 -84

Ref-2: Chapter-4, pp 65- 75

Chapter-2: Language Components

(6 L)

Introduction, Control Flow and Syntax, If Statement, While Loop, Break and Continue, For Loop, Lists (Concept, Creating, Accessing, Updating, Deleting, Built-in functions, List comprehensions), Functional programming tools (filter(), map(), reduce()), Tuples, Sets, Dictionaries, Dictionary operations and functions.

Ref-1: Chapter-7,8 pp 93 -198

Ref-2: Chapter-4,9 pp125 -165,337 -375

Module-2

[12L+3T]

Chapter-3: Functions and Modules

(6 L)

Introduction, Defining Functions, Function Parameters, Scope of Variables, Function Documentation, Variable Number of Arguments, Keyword and Optional Parameters, Lambda, Modules, Standard Modules (sys, math, time), The dir Function.

Ref-1: Chapter-9,11 pp 99 -102, 141- 168

Ref-3: Chapter-7 pp120 - 120

Chapter-4: Objects and Classes

(2 L)

Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, File Organization.

Ref-1: Chapter-10 pp 169 - 198

Ref-4: Chapter-6 pp 206 - 210

Chapter-5: I/O and Error Handling in Python

(4 L)

Introduction, Data Streams, Access Modes, File Handling (Reading, Writing), Using Pipes, Handling IO Exceptions, Working with Directories, Metadata, Errors, Exception Handling, Exception Hierarchy, Handling Multiple Exceptions.

Ref-1: Chapter-14, pp 259 – 267

References:

1. "Introducing Python - Modern Computing in Simple Packages" – Bill Lubanovic, O'Reilly Publication.
2. "Beginning Python: From Novice to Professional" – Magnus Lie Hetland, Apress.
3. "Practical Programming: An Introduction to Computer Science Using Python 3" – Paul Gries, et al., Pragmatic Bookshelf, 2/E 2014.
4. "Introduction to Computer Science Using Python" – Charles Dierbach, Wiley Publication.
5. "Learning with Python" – Green Tea Press, 2002.

Course Outcomes (CO): SDMAT-351: Python Programming

CO-1: Identify, characterize, and define a problem.

CO-2: Use the Python programming language effectively.

CO-3: Utilize different control structures in Python.

CO-4: Begin implementing functional code.

Major Theory Paper-10, SEM-V

SDMAT-352: Go Programming

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Go Programming	3
	Language Components	3
	Working with Data	3
	Methods and Interfaces	3
II	Goroutines and Channels	4
	Packages and Testing	4
	Working with Go	4

Module-1

[12L+3T]

Chapter-1: Introduction to Go Programming

(3 L)

The Go Programming Language: History, Features, Applications, Installing Golang, Running Simple Go programs. Basics of Go Programming – Go Runtime and Compilations, Keywords and Identifiers, Constants and Variables, Operators and Expressions, Local Assignments, Booleans, Numerics, Characters, Pointers and Addresses, Strings.

Ref-1: Chapter 1, 2, 3 pp 1 to 75 Ref-2: <https://gobyexample.com/>

Chapter-2: Language Components

(3 L)

If-else and switch, for Statements, Counter-controlled Iterations, Condition-controlled Iterations, Range Loops, Using break and continue, Parameters and Return Values, Call by Value and Reference, Named Return Variables, Blank Identifiers, Variable Argument Parameters, Using defer statements, Recursive Functions, Functions as Parameters, Closures.

Ref-1: Chapter 5 pp 119 to 151 Ref-2: <https://gobyexample.com/>

Chapter-3: Working with Data

(3 L)

Array Literals, Multidimensional Arrays, Array Parameters, Slices and Slice Parameters, Multidimensional Slices, Reslicing, Maps and Map Parameters, Map Slices, Structures and Structure Parameters, Structure Tags and Fields, Embedded Structures, Recursive Structures.

Ref-1: Chapter 1 pp 81 to 107 Ref-2: <https://gobyexample.com/>

Chapter-4: Methods and Interfaces

(3 L)

Method Declarations, Functions vs. Methods, Pointer and Value Receivers, Method Values and Expressions, Interface Types and Values, Type Assertions and Type Switches, Method Sets with Interfaces, Embedded Interfaces, Empty Interfaces, Working with Interfaces.

Ref-1: Chapter 6 and 7 pp 171 to 210 Ref-2: <https://gobyexample.com/>

Module-2

[12L+3T]

Chapter-5: Goroutines and Channels

(4 L)

Concurrency vs. Parallelism, Goroutine Functions and Lambdas, Wait Groups, Channels, Sending and Receiving Unbuffered and Buffered Channels, Directional Channels, Multiplexing with Select, Timers and Tickers.

Ref-1: Chapter 8 and 9 pp 217 to 280 Ref-2: <https://gobyexample.com/>

Chapter-6: Packages and Testing

(4 L)

Packages and Workspaces, Exporting Package Names, Import Paths and Named Imports, Package Initializations, Blank Imports, Unit Testing with Test Functions, Table Tests and Random Tests, Benchmarking.

Ref-1: Chapter 10 and 11 pp 283 to 326 Ref-2: <https://gobyexample.com/>

Chapter-7: Working with Go

(4 L)

Files and Directories, Reading Directories, Reading Files, Writing Files, Copying Files, Error Strategies, Panic and Recover, Package Error Handling, Regular Expressions.

Ref-2: <https://gobyexample.com/>

References:

1. "The Go Programming Language" by Alan A.A. Donovan & Brian W. Kernighan.
2. "Go by Example": <https://gobyexample.com/> - A site providing simple and clear examples of common Go programming tasks, including file handling and regular expressions.

Course Outcomes (CO): SDMAT-352: Go Programming

CO-1: Develop web applications (server-side) using Go.

CO-2: Use the Go programming language effectively.

CO-3: Work with slices, maps, reslicing, and embedded structures.

CO-4: Implement functional and structured programming in Go.

Major Theory Paper-11, SEM-V

SDMAT-353: Cloud Computing

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Cloud Computing Overview	6
	Abstraction and Virtualization	6
II	Programming, Environments and Applications	6
	Security in The Cloud Security Overview	6

Module-1

[12L+3T]

Chapter-1: Introduction to Cloud Computing Overview

(6 L)

Layers and Types of Cloud, Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Multitenant Technology. Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology. Infrastructure as a Service, Platform as a Service, Software as a Service, Cloud Deployment Models.

Ref-3 pp. 11-15, Ref-1 pp. 11-16

Chapter-2: Abstraction and Virtualization

(6 L)

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Provisioning in the Cloud Context Virtualization of CPU, Memory, I/O Devices, Virtual Clusters and Resource management

Ref-1 pp. 109-159, Ref-2 pp. 156-183

Module-2

[12L+3T]

Chapter-3: Security in The Cloud Security Overview

(6 L)

Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control, Disaster Recovery in Clouds

Ref-1 pp. 213-230

Chapter-4: Programming, Environments and Applications

(6 L)

Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Applications:

Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications.

Ref-3 pp. 341-354

References:

1. Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center by Brian J.S. Chee and Curtis Franklin CRC Press, ISBN :9781439806128
2. Mastering Cloud Computing: Foundations and Applications Programming by RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi

Course Outcomes (CO): SDMAT-353: Cloud Computing

- CO-1: Understand the fundamental concepts of cloud computing, including service models (IaaS, PaaS, SaaS), deployment models, and cloud-enabling technologies.
- CO-2: Analyze the architecture and features of cloud infrastructure and evaluate the advantages, limitations, and desired features of cloud-based systems.
- CO-3: Apply virtualization technologies in the context of cloud computing, including provisioning, migration, and resource management using virtual machines and hypervisors.
- CO-4: Demonstrate proficiency in using popular cloud platforms such as AWS, Microsoft Azure, and Google Cloud for application development and deployment.
- CO-5: Evaluate cloud security issues, including data security, identity management, and disaster recovery, and propose effective solutions for secure cloud deployment.

Major Theory Paper-12, SEM-V

SDMAT-354: Internet of Things

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction To IoT	6
	IoT Programming	6
II	IoT Applications	4
	Network Of Wireless Sensor Nodes	4
	Mac, Routing And Transport Control In Wsn	4

Module-1

[12L+3T]

Chapter-1: Introduction To IoT

(6 L)

Definition and Characteristics, Physical Design Things- Protocols, Logical Design- Functional Blocks, Communication Models, Communication APIs, Introduction to measure the physical quantities,

IoT Enabling Technologies, Wireless Sensor , Networks, Cloud Computing Big Data Analytics, Communication Protocols, Embedded System- IoT Levels and Deployment Templates.

Ref-3 pp. 11-15, Ref-1 pp. 11-16

Chapter-2: IoT Programming

(6 L)

Introduction to Smart Systems using IoT ,IoT Design Methodology-

IoT Boards (Raspberry ,Pi, Arduino) and IDE ,Case Study: Weather Monitoring, Logical Design using Python, Data types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling ,Date/Time Operations, Classes, Python Packages of Interest for IoT.

Ref-1 pp. 109-159, Ref-2 pp. 156-183

Module-2

[12L+3T]

Chapter-3: IoT Applications

(6 L)

Home Automation , Smart Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle, IoT and M2M

Ref-1 pp. 213-230

Chapter-4: Network Of Wireless Sensor Nodes

(6 L)

Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Applications:

Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications.

Ref-3 pp. 341-354

Chapter-4: Mac, Routing And Transport Control In Wsn

(6 L)

Introduction ,Fundamentals of MAC Protocols ,MAC protocols for WSN ,Sensor MAC ,Case Study – Routing Challenges and Design Issues – Routing Strategies – Transport Control Protocols – Transport Protocol Design Issues Performance of Transport Protocols

References:

1 Internet of Things by Michael McCarthy, Barry Burd, Ian Pollock

2 Springer Handbook of Internet of Things by Dr. Sébastien Ziegler

Dr. Renáta Radócz

Course Outcomes (CO): SDMAT-354: Internet of Things

CO-1: Understand the concepts of IoT and IoT enabling technologies.

CO-2: Gain knowledge on IoT programming and able to develop IoT applications.

CO-3: Identify different issues in wireless ad hoc and sensor networks.

CO-4: To understand the layered approach in sensor networks and WSN protocols.

CO-5: To develop an understanding of sensor network architectures from a design and performance perspective .

Major Practical Paper-5, SEM-V

SDMAP-355: Python Programming Lab **[Practical, 2 Credits Paper, 60 L]**

List of Experiments:

1. Write a Python program to print 'Hello World'.
2. Write a Python program to print 'Hello World' using a string variable.
3. Write a Python program to store data in a list and then print them.
4. Write a Python program to perform basic trimming and slicing on a string.
5. Write a Python program to print a list of numbers using range and a for loop.
6. Write a Python program to store strings in a list and then print them.
7. Write a program that returns a list containing only the elements that are common between two lists (without duplicates). Ensure the program works for lists of different sizes.
8. Write a Python program that lets the user enter some data in a string, then verifies the data and prints a welcome message.
9. Write a Python program in which a function is defined, and calling that function prints 'Hello World'.
10. Write a Python program in which a function (with a single string parameter) is defined, and calling that function prints the string parameter given to the function.

Course Outcomes (CO): SDMAP-355: Python Programming Lab

- CO-1: Develop algorithmic solutions to simple computational problems.
CO-2: Develop and execute simple Python programs.
CO-3: Solve problems using Python programs.
CO-4: Represent compound data using Python lists, tuples, and dictionaries.
CO-5: Read and write data from/to files in Python programs.

Major Practical Paper-6, SEM-V

SDMAP-356: Lab Course on Go

[Practical, 2 Credits Paper, 60 L]

List of Experiments:

1. Setting up Go Environment and Writing a Simple Program to print 'Hello World'.
2. Demonstrating Go Variables, Constants, and Data Types.
3. Control Structures in Go.
4. Functions and Parameters, Structures, and Methods.
5. Arrays, Slices, and Maps in Go.
6. Concurrency with Goroutines.
7. Working with Channels.
8. Creating and Using Go Packages.
9. Writing Unit Tests in Go.
10. Error Handling and Panic/Recover.
11. File Operations in Go.
12. Working with regular expressions in Go.

Course Outcomes (CO): SDMAP-356: Lab Course on Go

- CO-1: Understand and apply Go syntax and semantics.
- CO-2: Create and use slices, maps, and structures in Go, and understand their differences.
- CO-3: Implement concurrent programs using Goroutines and Channels.
- CO-4: Apply error handling techniques using Go's built-in error interface and the panic/recover mechanisms.
- CO-5: Perform file I/O operations like reading, writing, copying files, and handling directory structures.

Major Elective Theory Paper-1-A, SEM-V

SDMET-351A: Node.js [Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Node.js	3
	Node.js Basics	4
	Node.js Modules	5
II	File System and Events	4
	Database Connectivity	4
	EXPRESS and Node.js	4

Module-1

[12L+3T]

Chapter-1: Introduction to Node.js

(3 L)

Features and advantages of Node.js, Traditional Web Server Model, Node.js Process Model, Asynchronous programming with Node.js, Types of applications that can be developed using Node.js.

Ref-1 pp. 12-23, Ref-2 pp. 01-17

Chapter-2: Node.js Basics

(4 L)

Installing Node.js on Windows, working in REPL, Node.js Console, Creating a Node File with JavaScript, Accessing a Node.js File Through the Command Line Interface, Using Node.js in NetBeans IDE, Primitive Types, Object Literals, Functions, Buffer, Accessing Global Scope.

Ref-1 pp. 12-23, Ref-2 pp. 01-17

Chapter-3: Node.js Modules

(5 L)

Module, Module Types: Core Modules, Local Modules, Third-Party Modules, Module Exports. Using Modules in a Node.js File, Using the Built-in HTTP, URL, Query String Module, Creating a Custom Module. Node Package Manager (NPM): Installing Packages Locally, Adding dependencies in package.json, Installing packages globally, Updating packages.

Ref-1 pp. 36-48, Ref-1 pp. 85-111

Module-2

[12L+3T]

Chapter-4: File System and Events

(4 L)

Reading, Writing a File, Writing a file asynchronously, Opening a file, Deleting a file, Other IO operations.

EventEmitter class, Methods and Events of EventEmitter Class, Returning event emitter, Extending EventEmitter Class, Passing Arguments and `this` to listeners, Asynchronous and Synchronous call, Handling Events only Once, Error Events.

Ref-3 pp. 53-78, Ref-1 pp. 118-139

Chapter-5: Database Connectivity (4 L)

Connection string, Configuring, Working with insert, select commands, Updating records, Deleting records, Dropping tables, Ordered Result Set.

Ref-1 pp. 183-215

Chapter-6: EXPRESS and Node.js (4 L)

Introduction to Express Framework, Express Server Request-Response Routes, Route Parameters, Multiple Route Callback/Handler Functions, Methods of Response Object, Chaining Route Handlers, Sending Static Files, Accepting User Input, File Upload with Express, Managing Cookies, Sending files as a response, Templates and Express.

Ref-1 pp. 222-258

Reference Books:

1. "Node.JS Guidebook" by Dhruti Shah, BPB Publications, 2018.
2. "Beginning Node.js" by Basarat Ali Syed, Apress, 2014.

Course Outcomes (CO): SDMET-351A: Node.js

CO-1: Design, develop, and deploy backend applications using Node.js that can handle real-time communication, large-scale API requests, and asynchronous tasks efficiently.

CO-2: Design and implement RESTful APIs, understand HTTP methods, and manage server-side routing in Express.js.

CO-3: Integrate databases, implement user authentication, and manage file uploads.

CO-4: Deploy applications on popular cloud platforms and optimize them for performance and scalability.

Major Elective Theory Paper-2-A, SEM-V

SDMET-352A: Kotlin [Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction	4
	Function & Object-Oriented Programming (OOP)	4
	Extension Functions and Properties	4
II	Coroutines and Reflection	4
	Working with Android Development	4
	Using Kotlin Features in Android	4

Module-1

[12L+3T]

Chapter-1: Introduction

(4 L)

History, Kotlin Advantages, How Kotlin Programs Work? Kotlin software prerequisites, Creating a Kotlin Program, Writing comments, Kotlin Variables, Kotlin Data Types, Input of Information to Kotlin Program.

Ref-1 pp. 13-21

Chapter-2: Function & Object-Oriented Programming (OOP)

(4 L)

Function, Function Structure, Creating a Function, Function and variable scope, Object-Oriented Programming (OOP), Objects and Classes.

Kotlin collection (Class HashMap, Class ArrayList, Method mutableListOf).

Ref-1 pp. 43-51

Chapter-3: Extension Functions and Properties

(4 L)

Extension functions and how they work, Defining extension functions for existing classes, Extension properties.

Delegation in Kotlin (by keyword for delegating methods and properties, Standard library delegation (Lazy, Observable, etc.)).

Ref-1 pp. 269-282

Module-2

[12L+3T]

Chapter-4: Coroutines and Reflection

(4 L)

Coroutines and concurrency in Kotlin, Creating and launching coroutines, suspend functions and async/await, Coroutine builders and scopes (launch, async, etc.), Handling exceptions in coroutines.

Reflection in Kotlin, Using the KClass type, Annotations and their use in Kotlin.

Ref-1 pp. 343-352

Chapter-5: Working with Android Development (4 L)

Introduction to Android development with Kotlin, Setting up Android Studio with Kotlin, Building your first Android application in Kotlin.

Ref-2 pp. 1-12

Chapter-6: Using Kotlin Features in Android (4 L)

Kotlin Android Extensions, Null safety in Android views, Data classes in Android (for models), Coroutine usage in Android for background tasks.

Ref-2 pp. 69-79

Reference Books:

1. "Kotlin Programming: The Big Nerd Ranch Guide" (E-Book).
2. "Learn Kotlin for Android Development".

Course Outcomes (CO): SDMET-352A: Kotlin

- CO-1: Write and execute Kotlin programs to solve real-world problems using Kotlin syntax, libraries, and tools.
- CO-2: Design and implement classes, interfaces, and data classes in Kotlin.
- CO-3: Handle exceptions appropriately in Kotlin using try-catch blocks and custom exception classes.
- CO-4: Build Android applications using Kotlin, following best practices for UI design, app architecture, and asynchronous tasks.

Major Elective Practical Paper-1-A, SEM-V

SDMEP-353A: Node.js & Kotlin Lab **[Practical, 2 Credits Paper, 60 L]**

List of Experiments:

Setting Up Node.js Development Environment

1. Install Node.js and set up the development environment.

Exploring Node.js REPL

1. Experiment with basic Node.js commands like `console.log()`, defining variables, and performing simple arithmetic.
2. Test asynchronous behavior by using `setTimeout()` and `setInterval()` in the REPL.

Working with Node.js Core Modules

1. Create a simple Node.js application to read a file asynchronously using the `fs` module.
2. Use the `path` module to manipulate file paths.

Managing Packages Using npm

1. Initialize a new Node.js project using `npm init` and create a `package.json` file.
2. Update and remove installed packages using `npm update` and `npm uninstall`.

Creating and Using Custom Modules and Built-In Modules

1. Create custom modules and import them into a Node.js application.
2. Use built-in modules like `url`, `querystring`, and `http`.

File System Operations

1. Create a script to read from and write to a text file using the `fs.readFile()` and `fs.writeFile()` methods.
2. Implement an asynchronous file operation that reads the content of a file and appends new text to it.

Handling Events with EventEmitter

1. Create a real-time logging system that emits and listens for log messages.

Database Connectivity

-
1. Connect to a MongoDB database using Mongoose.
 2. Create a simple model for a 'User' and perform basic CRUD operations (Create, Read, Update, Delete).

Express and Node.js

1. Create a basic Express application that listens on a specific port.
2. Create a simple contact form and handle POST requests to submit user input.

Kotlin:

1. Set up the Kotlin development environment (IntelliJ IDEA or Android Studio).
2. Write simple Kotlin programs using basic syntax.
3. Write a function to calculate the factorial of a number using recursion.
4. Implement a lambda expression and pass it to a higher-order function.
5. Create a Student class that inherits from the Person class, adding properties like roll number and course.
6. Override a method in the Student class to customize the display of student details.
7. Write a program that simulates a basic calculator with try-catch blocks to handle division by zero and other potential exceptions.
8. Demonstrate the use of forEach, map, filter, and reduce on collections.
9. Write a simple coroutine that simulates a long-running task (e.g., downloading data) and use delay() to simulate asynchronous behavior.
10. Write a Kotlin program to read from and write to a file. Demonstrate reading line by line and writing data to a text file.
11. Set up a new Android project using Kotlin in Android Studio.

Course Outcomes (CO): SDMEP-353A: Node.js & Kotlin Lab

- CO-1: Independently create and run basic Node.js applications, understanding the underlying architecture, including modules and asynchronous I/O.
- CO-2: Develop and modularize applications using custom modules, improving code organization and scalability.
- CO-3: Implement error handling, middleware, and user input validation in API development.
- CO-4: Build a simple real-time chat application or live notification system.
- CO-5: Handle file uploads, file reading/writing, and file deletion with Node.js and Express.
- CO-6: Write, compile, and execute Kotlin programs to solve real-world problems using its syntax, libraries, and tools.
- CO-7: Develop applications in both object-oriented and functional programming paradigms.
- CO-8: Use Kotlin-specific features such as data classes and sealed classes for clean and expressive designs.
- CO-9: Develop Android apps with Kotlin, leveraging features like Android Extensions, view binding, and coroutines for background processing.

Major Elective Theory Paper-1 B, SEM-V

SDMET-351B: Web Analytics and SEO

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Web Analytics and SEO	2
	Web Analytics Tools and Metrics	5
	SEO Techniques and Best Practices	5
II	SEO Strategy and Analytics Integration	4
	SEO and Analytics Case Studies and Tools	4
	Emerging Trends and Future of SEO	4

Module-1

[12L+3T]

Chapter-1: Introduction to Web Analytics and SEO

(2 L)

Web Analytics Definition, importance, and application in business.

Introduction to SEO, its importance for web visibility.

Key Concepts: Keywords, Search Engine Results Pages (SERPs), Traffic, Conversion.

Ref-1 pp. 1-20 Ref-2 pp. 1-18

Chapter-2: Web Analytics Tools and Metrics

(5 L)

Google Analytics Setup: Creating and configuring an account, tracking code, goals.

Metrics in Web Analytics: Traffic sources, bounce rate, page views, conversion rate, user behavior.

Advanced Google Analytics Features: Setting up custom reports, segmentation, and event tracking.

Ref-1 pp. 50-75 Ref-2 pp. 50-90

Chapter-3: SEO Techniques and Best Practices

(5 L)

On-page SEO: Keyword research, optimizing meta tags, content optimization.

Off-page SEO: Link building, social signals, and online reputation management.

Technical SEO: Website architecture, mobile SEO, site speed optimization.

Ref-1 pp. 21-49 Ref-2 pp. 120-200

Module-2

[12L+3T]

Chapter-4: SEO Strategy and Analytics Integration

(4 L)

SEO Performance Metrics: How to measure SEO success.

Web Analytics for SEO: Using web analytics to track SEO performance.

Adjusting SEO Strategies Based on Analytics: Fine-tuning SEO based on insights from Google Analytics.

Ref-1 pp. 160-190 Ref-2 pp. 220-240

Chapter-5: SEO and Analytics Case Studies and Tools

(4 L)

SEO Tools: Moz, Ahrefs, SEMrush – Using these tools for keyword research, backlinks, and ranking analysis.

Analytics in Practice: Hands-on exercises to analyze web traffic and SEO performance.

Ref-1 pp. 220-240 Ref-2 pp. 400-420

Chapter-6: Emerging Trends and Future of SEO

(4 L)

Mobile-first Indexing: Google's new indexing strategy and what it means for SEO.

AI and Automation in SEO: How artificial intelligence is shaping the future of SEO.

Voice Search and SEO: Optimizing for voice search queries.

Ref-2 pp. 480-500

References:

1. "Google Analytics" by Justin Cutroni.
2. "The Art of SEO: Mastering Search Engine Optimization" by Eric Enge, Stephan Spencer, and Jessie Stricchiola.

Course Outcomes (CO): SDMET-351B: Web Analytics and SEO

CO-1: Define key concepts related to Web Analytics and SEO, such as web analytics, SEO, keywords, SERPs, traffic, and conversion.

CO-2: Demonstrate the setup of Google Analytics by creating an account, configuring tracking code, and setting up goals to monitor website performance.

CO-3: Analyze web traffic data and SEO performance using Google Analytics and SEO tools like Moz, Ahrefs, and SEMrush, identifying patterns and suggesting improvements.

CO-4: Evaluate the effectiveness of different SEO techniques (on-page, off-page, and technical) and suggest appropriate strategies for improving website visibility and traffic.

CO-5: Design a comprehensive SEO strategy integrating web analytics, adjusting based on performance metrics, and incorporating emerging SEO trends like mobile-first indexing and AI.

Major Elective Theory Paper-2 B, SEM-V

SDMET-352B: E-Commerce

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to E-Commerce	6
	E-Business Technology & Security	6
II	Payment Systems & Web Customers	6
	Recent Trends in E-Commerce	6

Module-1

[12L + 3T]

Chapter-1: Introduction to E-Commerce

(6 L)

Definitions, history, and developments, Characteristics, advantages & disadvantages, Adoption and impact of E-Business, Types of e-transactions: B2B, B2C, C2C, C2B, etc., Electronic Storefronts & Marketplaces, Affiliate and Hybrid Models.

Ref-3 pp. 11–15, Ref-1 pp. 11–16

Chapter-2: E-Business Technology & Security

(6 L)

Web presence: domain registration, website development & hosting, Web server hardware & software, Data center services, Security: service providers, digital certificates, encryption, SSL, digital signatures.

Ref-1 pp. 109–159, Ref-2 pp. 156–183

Module-2

[12L + 3T]

Chapter-3: Payment Systems & Web Customers

(6 L)

Cyber wallets, mobile payments, NFC, Payment service providers: PayPal, Paytm, etc., Payment gateways: standards, integration, banking & legal issues, Customer satisfaction & loyalty, Banking and dispute resolution policies, Cyber laws.

Ref-3 pp. 341–354

Chapter-4: Recent Trends in E-Commerce

(6 L)

Artificial Intelligence (AI) in E-Commerce, Cloud Computing for Online Business, Internet of Things (IoT) and Smart Commerce, Augmented Reality (AR) & Virtual Reality (VR) in Shopping, Social Commerce and Voice Commerce.

Ref-1 pp. 213–230

Reference Books:

1. **Brian J. S. Chee and Curtis Franklin**
Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center
CRC Press, ISBN: 9781439806128
2. **Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi**
Mastering Cloud Computing: Foundations and Applications Programming
McGraw Hill, ISBN: 9781259029950, 1259029956

Course Outcomes (CO): SDMET-352B: E-Commerce

CO-1: Understand the fundamental concepts of E-Commerce, including its definitions, evolution, characteristics, advantages & disadvantages, and various electronic transaction models such as B2B, B2C, C2C, and C2B.

CO-2: Analyze the technological foundations of E-Business by examining web presence requirements, website development, hosting, server configurations, data center services, and essential security mechanisms such as SSL, encryption, digital certificates, and digital signatures.

CO-3: Apply knowledge of electronic payment systems by understanding cyber wallets, mobile payments, NFC, payment gateways, banking/legal issues, and evaluate customer satisfaction, loyalty, and dispute-resolution processes in online transactions.

CO-4: Demonstrate awareness of cyber laws, security policies, and regulatory frameworks relevant to E-Commerce to ensure safe and legally compliant online business practices.

CO-5: Evaluate recent trends in E-Commerce, including AI, Cloud Computing, IoT-based smart commerce, AR/VR shopping experiences, social commerce, and voice commerce, and assess their impact on modern digital business environments.

Major Elective Practical Paper-1-B, SEM-V

SDMEP-353B: Web Project **[Practical, 2 Credits Paper, 60 L]**

List of Experiments:

1. Project Planning and Analysis
2. Designing the Project Structure
3. Implementing Core Functionality
4. User Interface Design and Development-I
5. User Interface Design and Development-II
6. User Interface Design and Development-III
7. Data Handling and Storage-I
8. Data Handling and Storage-II
9. Testing and Quality Assurance
10. Documentation-I
11. Documentation-II

Course Outcome:

- CO-1:** Student will be able to explain the principles and functionalities of Programming Languages and its role in web development.
- CO-2:** Student will be able to summarize the process of handling user input and form submissions.
- CO-3:** Student will be able to apply programming concepts and techniques to integrate databases and perform CRUD operations (create, read, update, delete) on data
- CO-4 :** Student will be able to evaluate the efficiency and effectiveness of different programming approaches in web application development.
- CO-5 :** Student will be able to design and develop a comprehensive project from scratch, integrating various features like user authentication, data validation, and database interactions.
- CO- 6:** Student will be able to innovate and implement advanced functionalities using frameworks and libraries.

Vocational Skill Course Practical Paper-2, SEM-V

SDVSP-351: Lab on Hosting and Deployment of Websites [Practical, 2 Credits Paper, 60 L]

List of Experiments:

1. Introduction to Local Hosting:

- Install and configure XAMPP on Windows.
- Set up a local server environment using Apache.
- Host a basic 'Hello World' HTML page locally.

Tools: XAMPP (<https://www.apachefriends.org/index.html>)

2. Domain Name and DNS Setup:

- Register a free domain name using Freenom.
- Set up Cloudflare for DNS management.
- Map the domain to a local website using a free tunneling service like Ngrok.

Tools: Freenom (<https://www.freenom.com>), Cloudflare (<https://www.cloudflare.com>), Ngrok (<https://ngrok.com>)

3. Website Deployment via FTP:

- Install and configure FileZilla on Windows.
- Deploy a static HTML/CSS/JavaScript website to a free hosting platform like InfinityFree.
- Test and verify the deployed website.

Tools: FileZilla (<https://filezilla-project.org>), InfinityFree (<https://www.infinityfree.net>)

4. Static Website Hosting:

- Create a simple static website.
- Deploy the website to GitHub Pages.
- Configure a custom domain for the GitHub Pages site.

Tools: Git (<https://git-scm.com>), GitHub Pages (<https://pages.github.com>)

5. Dynamic Website Hosting – Part 1:

- Develop a simple dynamic website using PHP and MySQL.
- Host the website on a free PHP hosting service like 000WebHost.
- Test dynamic features like form submissions and database connectivity.

Tools: XAMPP (PHP/MySQL), 000WebHost (<https://www.000webhost.com>)

6. Dynamic Website Hosting – Part 2:

- Install and configure WordPress on Windows using XAMPP.
- Host the WordPress site on InfinityFree.
- Test WordPress themes, plugins, and customizations.

Tools: WordPress (<https://wordpress.org>), InfinityFree

7. Website Performance Optimization:

- Optimize website performance by compressing images using free tools like TinyPNG.
- Enable browser caching and Gzip compression using .htaccess.

-
- Integrate a free CDN service (e.g., Cloudflare) for asset delivery.
- Tools: TinyPNG (<https://tinypng.com>), Cloudflare

8. Securing the Website:

- Install SSL certificates using ZeroSSL or Cloudflare.
 - Redirect HTTP traffic to HTTPS.
 - Set up basic security rules in Cloudflare (e.g., blocking malicious traffic).
- Tools: ZeroSSL (<https://zerossl.com>), Cloudflare

9. Continuous Deployment:

- Set up version control for a project using Git.
 - Implement automatic deployment pipelines using GitHub Actions.
 - Test deployments for code updates.
- Tools: GitHub Actions (<https://docs.github.com/en/actions>)

10. Website Monitoring:

- Add Google Analytics to a website for user tracking.
 - Use free uptime monitoring tools like Uptime Robot to track website availability.
 - Analyze server logs using XAMPP logs.
- Tools: Google Analytics (<https://analytics.google.com>), Uptime Robot (<https://uptimerobot.com>)

11. Backup and Recovery:

- Use free backup tools like Duplicati to back up website files.
 - Back up and restore a MySQL database using phpMyAdmin.
 - Test restoring a website from backup.
- Tools: Duplicati (<https://www.duplicati.com>), phpMyAdmin (via XAMPP)

12. Capstone Project:

- Build and deploy a complete website project:
 - * Frontend: HTML/CSS/JavaScript.
 - * Backend: PHP/MySQL or WordPress.
 - * Hosting: InfinityFree or 000WebHost.
- Integrate analytics, optimization, and security features.
- Present the project to peers or instructor.

Course Outcomes (CO): SDVSP-351: Lab on Hosting and Deployment of Websites

CO-1: Understand Website Hosting Environments.

CO-2: Configure Domains and DNS for Websites.

CO-3: Deploy Static and Dynamic Websites.

CO-4: Implement Website Security Measures.

CO-5: Automate Deployment Workflows.

CO-6: Monitor and Maintain Hosted Websites.

CO-7: Develop and Deploy a Complete Web Application.

Major Theory Paper-13, SEM-VI

SDMAT-361: Mobile Web Development

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Android	3
	Activities, Fragments and Intents	4
	Android User Interface	5
II	Designing Your User Interface with Views	4
	Databases SQLite	4
	Location-Based Services and Google Map	4

Module-1

[12L+3T]

Chapter-1: Introduction to Android

(3 L)

Overview, History, Features of Android.

Architecture of Android, Tools – (JDK, SDK, Eclipse/Android Studio, ADT, AVD, Android Emulator). Versions, Creating your first Android Application.

Ref-1 pp. 01-27, Ref-2 pp. 01-19

Chapter-2: Activities, Fragments and Intents

(4 L)

Introduction to Activities, Activity Lifecycle. Introduction to Intents, Linking Activities using Intents. Calling built-in applications using Intents. Introduction to Fragments, Adding Fragments Dynamically. Lifecycle of Fragment, Interaction between Fragments.

Ref-1 pp. 27-81, Ref-3 pp. 53-70

Chapter-3: Android User Interface

(5 L)

Understanding the components of a screen, Adapting to Display Orientation. Anchoring Views, Resizing and Repositioning. Managing Changes to Screen Orientation, Persisting State Information during Changes in Configuration. Detecting Orientation Changes, Controlling the Orientation of the Activity. Utilizing Action Bar, Adding Action Items to the Action Bar. Customizing the Action Items and Application Icon.

Ref-3 pp. 149-166, Ref-2 pp. 81-125

Module-2

[12L+3T]

Chapter-4: Designing Your User Interface with Views

(4 L)

Using Basic Views, Button. Using Picker Views, Using List Views to Display Long Lists. Understanding Specialized Fragments, Displaying Pictures and Menus, Video View.

Ref-1 pp. 125-203

Chapter-5: Databases SQLite

(4 L)

Introduction to SQLite, SQLiteOpenHelper and SQLiteDatabase. Creating, opening and closing database. Working with cursors, Insert, Update, Delete. Building and executing queries.

Ref-3 pp. 541-560

Chapter-6: Location-Based Services and Google Map

(4 L)

Display Google Maps, Creating the project, Obtaining the Maps API Key. Displaying the Map, Displaying the Zoom Control, Changing Views. Navigating to a specific location, Adding Markers, Getting the location that was touched. Geocoding and Reverse Geocoding, Getting Location Data, Monitoring a Location.

Ref-1 pp. 301-331

Reference Books:

1. Wei-Meng Lee - Beginning Android 4 Application Development, WILEY India Edition, WROX Publication.
2. Reto Meier - Professional Android 4 Application Development, WROX Publication.
3. The Big Nerd Ranch Guide - Android Programming.

Course Outcomes (CO): SDMAT-361: Mobile Web Development

CO-1: Identify the basic knowledge on mobile application environment and technology.

CO-2: Explain the concepts and processes of mobile application development.

CO-3: Deploy applications to the Android marketplace for distribution.

CO-4: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.

CO-5: Critique mobile applications on their design pros and cons.

Semester- VI Major Theory Paper-14
MVMAT-362 Operating Systems & Shell Scripting
[Theory, 2 Credits Paper, 30 L]

Module	Name of the Chapter	No. of lecture
I	Introduction to Operating Systems	4
	Process Management	4
	Memory Management	4
II	Introduction to Shell Scripting	4
	Advanced Shell Programming	4
	Practical Applications and Case Studies	4

Note: Each lecture is of 1 hour

Module-1 Operating Systems Fundamentals **[12L+3T]**

Chapter-1: Introduction to Operating Systems **[4 L]**

Definition, Types of Operating Systems, Functions, System Components, System Calls, OS Services.

Ref-1: Chapter-1 pp 1-20,

Ref-2: Chapter-2 pp 15-30,

Chapter-2: Process Management **[4 L]**

Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, CPU Scheduling Algorithms.

Ref-1: Chapter-4, pp 55-80

Ref-2: Chapter-19 pp 345-360,

Chapter-3: Memory Management **[4 L]**

Memory Allocation, Paging, Segmentation, Virtual Memory Concepts, Page Replacement Algorithms.

Ref-1: Chapter-13 pp 295-320

Ref-2: Chapter-20 pp 361-380

Module-2 Shell Scripting **[12L+3T]**

Chapter-4: Introduction to Shell Scripting **[4 L]**

Basics of UNIX/Linux Shells, Shell Types, Writing and Executing Shell Scripts, Variables, Control Structures.

Ref-2: Chapter-8 pp 135-160

Chapter-5: Advanced Shell Programming **[4 L]**

Functions, Debugging, Regular Expressions, awk, sed, grep, File Manipulation, Process Management in Scripts.

Ref-2: Chapter-9 pp 161-180

Chapter-6: Practical Applications and Case Studies **[4 L]**

Automating Tasks, Backup Scripts, Log Analysis, System Monitoring, Scheduling with cron, Real-world Scripting Scenarios.

Ref-2: Chapter-27 pp 501-520

Reference-1: “Operating Systems: Three Easy Pieces” -- **Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Publication:** Arpaci-Dusseau Books, 2018

Reference-2: “A Practical Guide to Linux Commands, Editors, and Shell Programming (3rd Edition)” – **Mark G. Sobell, Publication:** Prentice Hall, 2012

Course Outcome MVMAT-362 Operating Systems & Shell Scripting

At the end of course, student will able -

CO1: Explain the role, types, and functions of an operating system.

CO 2: Apply Process and Memory Management Techniques

CO 3: Develop Shell Scripts for System Automation

CO 4: Solve Real-world Problems using Shell Scripting

Major Theory Paper-15, SEM-VI

SDMAT-363: Web Application Testing and Debugging

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction	4
	Levels of Testing	4
	Types of Testing	4
II	Test Case Design	5
	Test Execution	4
	Introduction to JSPQuality and Process Improvement	3

Module-1

[12L+3T]

Chapter-1: Introduction

(4 L)

Software testing, Quality of Software, Importance of testing, Tools used for Testing. Manual and Automation Testing, Goals of Software Testing, Testing Principles. Test Characteristics of Good Test, Verification and Validation, V-Model, SDLC Vs STLC. Testing and Debugging, Useful terms in Testing: Error, Bug, Defect, Fault, and Failure.

Ref-1: Chapter 2, pp 25-43 **Ref-2:** Chapter 3, pp 63-69 **Ref-3:** Chapter 2, pp 1-46

Chapter-2: Levels of Testing

(4 L)

White/Glass Box Testing Techniques, Black Box Testing Techniques, Grey Box Testing. Unit Testing, Integration Testing, System Testing, Functional Testing, Non-Functional Testing. User Acceptance Testing.

Ref-1: Chapter 3 and 4, pp 73-105 **Ref-3:** Chapter 4, pp 37-114

Chapter-3: Types of Testing

(4 L)

Functional Testing: White Box Testing, Black Box Testing, Positive Testing, Negative Testing. Beta Testing, Live Environment Testing, Smoke Testing, Sanity Testing, Regression Testing. Formal Testing, Informal Testing, Monkey Testing, Re-Testing, Risk-Based Testing. Non-Functional Testing: Performance Testing, Load/Stress Testing, Usability Testing. Accessibility Testing, Security Testing.

Ref-1: Chapter 8, pp 193-205

Module-2

[12L+3T]

Chapter-4: Test Case Design

(5 L)

Testing GUI, Writing Test Cases, Reviewing Test Cases, Test Cases Template. Types of Test Cases, Difference between Test Scenarios and Test Cases. Test Environment setup, understanding different documents used in testing. Hardware and software requirements, Test case design for

Desktop, Mobile, Web Applications using Excel.

Ref-1: Chapter 15, pp 351-377 **Ref-2:** Chapter 22, pp 799-809 **Ref-3:** Chapter 7, pp 77-114

Chapter-5: Test Execution

(4 L)

Execute test cases, Error/Defect Detection and Reporting. DRE (Defect Removal Efficiency), Object, Types of Bugs, Art of Debugging. Debugging Approaches, Reporting the Bugs, Severity and Priority. Test Closure, Criteria for Test Closure, Test Summary Report.

Ref-1: Chapter 17, pp 434-452

Chapter-6: Quality and Process Improvement

(3 L)

Test Measurements, Test Metrics, Metric Life Cycle, Types of Manual Test Metrics.

Difference between Quality Assurance and Quality Control. Application of the concept of quality to software application. Testers' contribution to the quality of software application.

Ref-1: Chapter 17, pp 420-433

Reference Books:

1. Srinivasan Desikan, Gopalaswamy Ramesh - "Software Testing: Principles and Practices".
2. Perry, John Wiley - "Effective Methods of Software Testing".
3. "Foundations of Software Testing ISTQB Certification: 4th Edition".

Course Outcomes (CO): SDMAT-363: Web Application Testing and Debugging

CO-1: Understand the importance of testing techniques in software quality management and assurance.

CO-2: Identify various types of software risks and their impact on different software applications.

CO-3: Create test case scenarios for different applications using various testing techniques.

CO-4: Apply different testing methodologies used in industries for software testing.

CO-5: Identify defects and manage them for improving software quality.

Major Theory Paper-16, SEM-VI

SDMAT-364: Blockchain

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Blockchain	4
	Working Principles of Blockchain	4
	Cryptography and Bitcoin Fundamentals	4
II	Smart contracts	4
	Blockchain Use Cases and Development Tools	4
	Cyber Security and Blockchain	4

Module-1

[12L+3T]

Chapter-1: Introduction to Blockchain

(4L)

Overview, History, Definition of Blockchain, Key Characteristics: Decentralization, Immutability, Transparency, Component of Blockchain, Types of Blockchains: Public, Private, Consortium

Ref-2: Ch-1, pp- 3-13.

Chapter-2: Working Principles of Blockchain

(4L)

Understanding SHA-256 Hash, Immutable ledger, Distributed P2P Network, How Mining Works? (The Nonce and Cryptographic Puzzle)

Ref-3

Chapter-3: Cryptography and Bitcoin Fundamentals

(4L)

Cryptography (Private and public keys, hashing and digital signature), Cryptocurrency, Digital Currency Bitcoin, Ethereum, Smart Contract

Ref-1: Ch-5 & Ch-6, pp. 191–228, 266–268

Module-1

[12L+3T]

Chapter-4: Smart Contracts

(4L)

Ethereum Network, what is Smart Contract? Ethereum Virtual Machine, Ether, Gas, Dapps.

Ref-2: Ch-4, Ch-5 pp- 40-47

Chapter-5: Blockchain Use cases and Development Tools

(4L)

Blockchain Use cases, Supply Chain management, Healthcare and Finance, Voting system, In IoT(Internet of things), Education Industry.

Ref-2: Ch-3, Ch-7, pp. 23–32, pp- 59-66

Chapter-6: Cyber Security and Blockchain

(4L)

Implementing Blockchain in cybersecurity, Advantages of Using Blockchain in Cybersecurity, Disadvantages of Using Blockchain in Cybersecurity.

Ref-2: Ch-10, pp. 81-88

Reference Books:

Ref-1: Cryptography and Network Security- Atul Kahate

Ref-2: Blockchain technology and Applications- Ahmad Banafa

Ref-3: <https://www.slideshare.net/slideshow/chapter-2pptx-257149473/257149473>

Course Outcomes (CO): SDMAT-364: Blockchain

CO1: Explain the basic concepts, history, components, and characteristics of blockchain technology.

CO2: Describe how blockchain works, including SHA-256 hashing, immutable ledgers, P2P networks, and mining mechanisms.

CO3: Apply cryptographic principles such as public/private keys, hashing, and digital signatures in the context of cryptocurrencies.

CO4: Explain smart contracts, Ethereum network components, EVM, gas mechanisms, and Dapps.

CO5: Identify and analyse various blockchain use cases in supply chain, healthcare, finance, and voting systems.

CO6: Discuss major challenges in blockchain, including security attacks, scalability issues, regulations, and future trends like IoT, AI, and quantum computing.

Major Practical Paper-7, SEM-VI
SDMAP-365 Operating Systems & Shell Scripting Lab
[Practical, 2 Credits Paper, 60 L]

List of Experiments:

1. **Install a Linux Operating System using VirtualBox and create a virtual machine.**
2. Explore Linux desktop and terminal. Open terminal and execute basic commands.
3. Practice basic Linux commands (ls, pwd, cd, mkdir, rmdir, cp, mv, rm).
4. Create, copy, move, rename, and delete files and directories using commands.
5. Display currently running processes using ps and top.
6. Check memory and disk usage using free and df.
7. Write a simple shell script to print "Hello World".
8. Write a shell script to perform addition, subtraction, multiplication, and division of two numbers.
9. Write a shell script to check whether a number is even or odd.
10. Write a shell script to find factorial of a number using loop.
11. Write a shell script to find the largest of three numbers.
12. Use grep command to search a word in a text file and display matching lines.
13. Create a simple backup shell script to copy files from one directory to another.

Course Outcomes:

- CO-1:** Install and use a Linux operating system in a virtual environment.
- CO-2:** Perform basic operating system commands and process monitoring.
- CO-3:** Develop simple shell scripts using variables, conditions, and loops.
- CO-4:** Automate basic file handling and text processing tasks using shell scripting.

Major Practical Paper-8, SEM-VI

SDMAP-366: Lab on Mobile Web Development [Practical, 2 Credits Paper, 60 L]

List of Experiments:

1. Introduction to Android:

1. Install Android Studio and build a simple Hello World application.

2. Activities, Fragments and Intents:

1. Create an application to display details of a selected list item on a second activity (Use Fragmentation).
2. Create a first activity to accept information like first name, last name, date of birth, and email-id, and display all information on a second activity when the user clicks on the submit button.

3. Android User Interface and Event Handling:

1. Create a simple calculator that performs basic arithmetic operations.
2. Create an application to calculate GPA.

4. Designing Your User Interface with Views:

1. Create a custom 'Contact' layout to hold multiple pieces of information, including: Photo, Name, Contact Number, and Email ID.
2. Create an application to demonstrate a date and time picker.

5. Displaying Pictures and Menus:

1. Construct an app that toggles a light bulb on and off when the user clicks on a toggle button.
2. Create a gallery application to display all images date-wise (Use Grid View).

6. Databases – SQLite:

1. Create a login activity. If the Email and password match the database, display a 'login successful' message; otherwise, display an error message.
2. Construct a simple notes list that lets the user add new notes but not edit them. Demonstrates the basics of ListActivity using a SQLite database.
3. Create tables: Course (id, name, instructor) and Student (id, name). Course and Student have a many-to-many relationship. Create a GUI-based system for performing the following operations:
 - * Course: Add Course, View All students of a specific course
 - * Student: Add Student, Delete Student, View All students, Search Student.

7. Messaging and E-mail:

1. Create an application to send an email with validation.

8. Location-Based Services and Google Map:

1. Write a program to find the current location of an Android device and display details of the place like Street name and City using Geocoding.
2. Write a program to track an Android device using Google Maps.

Course Outcomes (CO): SDMAP-366: Lab on Mobile Web Development

CO-1: Understand and work with the Android SDK, including setting up devices and running applications on emulators or physical devices.

CO-2: Implement activities, fragments, and intents to manage different views and user interactions in an app.

CO-3: Create interactive, user-friendly interfaces using various Android layout types.

CO-4: Integrate Google Maps into applications for location tracking and geolocation features.

CO-5: Publish the app to the Google Play Store or distribute it through other methods.

Major Elective Theory Paper-2-A, SEM-VI

SDMET-361A: Angular Development

[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Angular Development	3
	Expression and Data Binding	3
	Modules, Controllers, and Data Binding	3
	AngularJS Scope and Events	3
II	Forms and Filters	3
	Directives	4
	React JS	5

Module-1

[12L+3T]

Chapter-1: Introduction to Angular Development

(3 L)

Introduction to AngularJS, Features of AngularJS, MVC Architecture: Conceptual Overview. Setting up the Environment, The Anatomy of an AngularJS app, First Application.

Ref-2: Chapter 1, pp 1-13

Chapter-2: Expression and Data Binding

(3 L)

Number and String Expressions, Object Binding and Expressions.

Working with Arrays, Understanding Data Binding.

Ref-3: Chapter 3, pp 10-16; Chapter 6, pp 31-37

Chapter-3: Modules, Controllers, and Data Binding

(3 L)

Module, Modular Programming, Controllers, Attaching Properties and Functions to Scope.

Adding Logic to the Controller, Adding Instance Functions and Properties to Controllers.

Dependency Injection in Controllers with Magnification, Two-Way Binding in AngularJS.

Ref-3: Chapter 4, pp 18-21; Chapter 5, pp 25-31; Chapter 6, pp 31-37

Chapter-4: AngularJS Scope and Events

(3 L)

Writing Access with Prototypes, Prototypal Inheritance in AngularJS Scopes, Advanced Scope

Concept. Watchers in AngularJS, Broadcasting & Emitting Events, Registering Listeners, Events in Action.

Ref-3: Chapter 5, pp 20-25; Chapter 21, pp 373-376

Module-2

[12L+3T]

Chapter-5: Forms and Filters

(3 L)

Using Simple Form, working with input, text area, select, radio button, checkbox control.

Input Validations and Custom Validations, Built-In Filters, Custom Filters.

Ref-2: Chapter 4, pp 49-68; Chapter 8, pp 121-134

Chapter-6: Directives

(4 L)

Creating Custom Directives, Compilation of Directives, Changing a Directive's Scope. Binding Between Parent Scope and Isolated Scope Models, Parent Scope vs. Child Scope vs. Isolated Scope. The Controller Function and Require, Cleaning Up Your Directive.

Ref-2: Chapter 2, pp 15-34; **Ref-3:** Chapter 9, pp 59-70

Chapter-7: React JS

(5 L)

React JS Basics & Features, Setup and Hello World Application, Components and Props. Function and Class Components, Rendering Components, Comment Box in React, Handling Events. Breaking the User Interface into a hierarchy of components, Creating forms, Animations, Two-way binding helper, Transferring props, React and Browsers.

Web Ref 3: Chapter 1

Reference Books:

1. Sandeep Panda - "AngularJS: Novice to Ninja: Elegant, Powerful, Testable, Extendable", SitePoint; 1st Edition, 2014.
2. Brad Green and Shyam Seshadri - "AngularJS – Up and Running", O'Reilly; 1st Edition, 2014.
3. Ari Lerner - "Ng-Book: The Complete Book on AngularJS", Lightning Source Inc; 1st Edition.

Web References:

1. <https://www.tutorialsteacher.com/angularjs/angularjs-validation-css-classes>
2. <https://docs.angularjs.org/tutorial>
3. <https://reactjs.org/docs/thinking-in-react.html>

Course Outcomes (CO): SDMET-361A: Angular Development

CO-1: Understand the fundamentals of AngularJS and its architecture.

CO-2: Create simple forms and apply input validations.

CO-3: Outline different types of expressions and data binding.

CO-4: Develop various React JS components.

Major Elective Theory Paper-2-B, SEM-VI

SDMET-361B: Dart [Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Dart	2
	Functional and Asynchronous Programming in Dart	4
	Streams in Dart	3
	Dart Libraries and Packages	3
II	File I/O in Dart	3
	Introduction to Flutter	4
	Testing and Debugging Dart Code	5

Module-1

[12L+3T]

Chapter-1: Introduction to Dart

(2 L)

History of Dart, Features and advantages of Dart. Dart's role in mobile (Flutter) and web development. Getters, Setters, and Mixins. Lists: Creating and manipulating lists, List operations (add, remove, sort, etc.). Sets: Defining sets and performing set operations.

Maps: Creating maps and key-value pairs, Iterating over maps and modifying them.

Ref-1: pp 25 to 43

Chapter-2: Functional and Asynchronous Programming in Dart

(4 L)

First-Class Functions, Closures, Higher-Order Functions. Lambda functions ($\Rightarrow$), Introduction to Asynchronous Programming. Synchrony vs. Asynchrony, Futures in Dart, Handling Futures using `.then()`. Using `async` and `await`, Error handling in asynchronous functions with `try-catch`.

Ref-1: pp 53 to 72.

Chapter-3: Streams in Dart

(3 L)

Introduction to Streams: Stream-based asynchronous programming. Synchronous vs. asynchronous streams. Using `await` for with Streams: Handling data from streams in an `async` loop.

Chapter-4: Dart Libraries and Packages

(3 L)

Importing Built-in Libraries: Using core libraries such as `dart:io`, `dart:convert`, `dart:async`, and `dart:math`. Importing and using external libraries. Creating and Publishing Dart Packages: Setting up a Dart package, Dependency management with `pubspec.yaml`, Using `pub get` to manage packages.

Ref-2: pp 29-31 Ref-3: Chapter 10

Module-2

[12L+3T]

Chapter-5: File I/O in Dart

(3 L)

Reading and Writing Files: File operations with dart:io, reading files asynchronously, writing files to disk. Working with Directories: Directory manipulation, Listing files and directories.

Ref-1: pp 80-90

Chapter-6: Introduction to Flutter

(4 L)

Overview of Flutter and Dart's role in mobile app development. Setting up Flutter environment. First Flutter app using Dart: Understanding Flutter widgets, Creating UI components with Flutter.

Ref-5: *"Flutter & Dart - The Complete Guide"* by Maximilian Schwarzmüller

Chapter-7: Testing and Debugging Dart Code

(5 L)

Introduction to Dart's testing framework (test package). Writing unit tests for Dart functions. Mocking objects and testing asynchronous code. Test-driven development (TDD) with Dart. Debugging tools in Dart: Using the Dart DevTools, debugging asynchronous code.

Handling errors and exceptions in Dart: Proper error handling and best practices. Using assert and throw for debugging.

Ref-4: <https://dart.dev/guides/testing>

Reference Books:

1. "Dart Up and Running" by Kathy Walrath & Seth Ladd.
2. "Learn Dart Programming" by Nathan Rozentals.
3. "Essential Dart" by Darryl F. R. T.
4. <https://dart.dev/guides/testing>.
5. "Flutter & Dart - The Complete Guide" by Maximilian Schwarzmüller.

Course Outcomes (CO): SDMET-361B: Dart

CO-1: Provide hands-on experience in applying Dart features to solve programming problems in a structured manner.

CO-2: Use Dart's support for functional programming, such as first-class functions, closures, and higher-order functions, to create more modular and reusable code.

CO-3: Understand how Dart is used in the development of mobile applications with Flutter, and gain familiarity with Flutter widgets and development techniques.

CO-4: Understand debugging techniques to troubleshoot and optimize Dart code effectively.

Major Elective Practical Paper-2-A, SEM-VI

SDMEP-362A: Lab on Angular Development

[Practical, 2 Credits Paper, 60 L]

List of Experiments:

1. Assignment to create a new Angular module called myApp.
2. Assignment to create a Controller for the Module.
3. Assignment to demonstrate Angular expressions inside the HTML to display the list of students in a table.
4. Implement two-way data binding in the ContactComponent form. Bind the input fields (name and email) to variables in the component class.
5. Assignment to demonstrate when the form is submitted, the values should be passed to the service and displayed as a success message.
6. Assignment to demonstrate a custom structural directive called appIf that behaves like Angular's built-in *ngIf directive.
7. Assignment to demonstrate a custom attribute directive appHighlight that changes the background color of an element when the mouse hovers over it.
8. Assignment to demonstrate the form with multiple phone numbers. The user should be able to add and remove phone numbers dynamically.
9. Assignment to demonstrate setup and Hello World Application.
10. Assignment to create a simple React component called WelcomeMessage that accepts a name prop and displays the message: 'Hello, [name]!' where [name] is the value passed in as a prop.

Course Outcomes (CO): SDMEP-362A: Lab on Angular Development

CO-1: Create modules, controllers, and demonstrate Angular expressions by using HTML.

CO-2: Implement two-way data binding.

CO-3: Create and manage custom attribute directives and forms using Angular development.

CO-4: Develop a simple React application.

Major Elective Practical Paper-2-B, SEM-VI

SDMEP-362B: Lab on Dart **[Practical, 2 Credits Paper, 60 L]**

List of Experiments:

1. Assignment to write simple Dart programs to demonstrate basic syntax, variables, and data types.
2. Assignment to demonstrate Dart Collections - Lists, Sets, and Maps.
3. Assignment to understand first-class functions, closures, and higher-order functions in Dart.
4. Assignment to understand how asynchronous programming works in Dart using Future, async, and await.
5. Assignment to demonstrate stream-based asynchronous programming in Dart.
6. Assignment to learn how to import and use Dart's core libraries and external packages.
7. Assignment to understand how to perform file operations in Dart.
8. Assignment to get familiar with the Flutter framework and how Dart is used for mobile app development.
9. Assignment to learn how to write unit tests, use Dart's testing framework, and debug code.

Course Outcomes (CO): SDMEP-362B: Lab on Dart

CO-1: Work confidently with Dart collections, functional programming, and asynchronous programming.

CO-2: Leverage Dart libraries and packages and perform file operations in Dart.

CO-3: Create basic Flutter applications that utilize Dart for UI design and component interaction.

CO-4: Write unit tests and debug Dart code.

Vocational Skill Course (VSC), SEM-VI
SDVST-361: Authentication and Authorization Mechanisms
[Theory, 2 Credits Paper, 30 L]

Module	Chapter No	No. of lecture
I	Introduction to Authentication and Authorization	3
	Username/Password Authentication	3
	Social Login and Single Sign-On (SSO)	3
	Multi-Factor Authentication (MFA)	3
II	Token-Based Authentication (JWT)	3
	Role-Based Access Control (RBAC)	3
	Attribute-Based Access Control (ABAC)	3
	Security Best Practices and Emerging Trends	3

Module-1

[12L+3T]

Chapter-1: Introduction to Authentication and Authorization

(3 L)

Overview of authentication and authorization in web applications, Understanding the importance of user identification and access control, Introduction to common authentication and authorization frameworks and standards.

Ref-1: Chapter-1, pp 2 to 9

Chapter-2: Username/Password Authentication

(3 L)

Storing and handling passwords securely, Implementing password hashing and salting techniques, Password recovery and reset mechanisms.

Ref-2: Chapter-3, pp 29-47

Chapter-3: Social Login and Single Sign-On (SSO)

(3 L)

Overview of OAuth and OpenID Connect protocols, Implementing social login with popular providers (e.g., Google, Facebook), Configuring and integrating identity providers for SSO.

Ref-3: Chapter-5 pp 35-73

Chapter-4: Multi-Factor Authentication (MFA)

(3 L)

Understanding MFA and its advantages, Implementing time-based one-time passwords (TOTP), Integrating MFA using authenticator apps or SMS.

Ref-5: Chapter-3, pp 24-33

Module-2

[12L+3T]

Chapter-5: Token-Based Authentication (JWT)

(3 L)

Introduction to JSON Web Tokens (JWT), Generating and validating JWT tokens, Securing token-based authentication with encryption and signatures.

Ref-4: Chapter 1 pp 4-16

Chapter-6: Role-Based Access Control (RBAC) (3 L)

Designing and implementing RBAC systems, Assigning roles and permissions to users, Managing and enforcing access control policies.

Ref-6: Chapter-5, pp 113-125

Chapter-7: Attribute-Based Access Control (ABAC) (3 L)

Overview of ABAC and its advantages, Defining attributes and policies for access control, Evaluating and enforcing ABAC policies.

Ref-6: Chapter-5, pp 113-125

Chapter-8: Security Best Practices and Emerging Trends (3 L)

Best practices for secure authentication and authorization, Implementing secure session management, Exploring emerging trends in authentication and authorization (e.g., passwordless authentication, zero-trust).

Ref-2: Chapter-4, pp 150-206

References:

1. Authentication and Authorization By Mark Morowczynski (Microsoft) and Michael Epping (Microsoft).
2. Authentication and Authorization on the Web by Nigel Chapman and Jenny Chapman.
3. The Definitive Guide to Single Sign On (SSO) by Ado Kukic.
4. Multi-factor authentication deployment guide.
5. The JWT Handbook by Sebastian Peyrott.
6. Improving Security, Privacy, and Trust in Cloud Computing - Pawan Kumar Goel, Hari Mohan Pandey, Amit Singhal, Sanyam Agarwal.

Course Outcomes (CO): SDVST-361: Authentication and Authorization Mechanisms

CO-1: Understand the structure and organization of computer security and cybercrimes.

CO-2: Gain a basic understanding of security techniques and functions.

CO-3: Develop an in-depth understanding of network security algorithms.

CO-4: Understand basic security threats.

CO-5: Understand firewalls, authentication, integrity, and system security design challenges.

Guideline for On Job Training and Internship Policy

- **Introduction:** All the Higher Educational Institutions (HEIs) are mandated to enable all the eligible students to take an active part in the Internship selection process. The Internship Cell constituted at the HEIs will extend all the possible support to the students. It will help in achieving the best-paid internship results in the given condition through the assistance and full cooperation of all the students, alumni, and recruiting organizations, making the HEI their most favored destination. The internship policy detailed hereunder will apply to academic session 2023-2024 onwards.

- **Background:** The National Education Policy (NEP)¹, 2020 suggests that students must actively engage with the practical side of their learning as part of a holistic education to further improve their employability. It states that students at all HEIs will be provided with opportunities for internships with local industry and businesses as well as research internships with faculty and researchers at their own or other HEIs/research institutions.

University Grants Commission (UGC) released National Credit Framework (NCrF)² in April 2023. It underscores the significance of experiential learning as part of the curricular structure through internships, on-the-job training, industrial projects, etc. The focus is further streamlined through the Guidelines for Internship/Research Internship released later in October 2023.

In line with the NEP and tracing the provisions of NcrF, Government of Maharashtra has subsequently released two Government Resolutions (GRs)³ to reinforce NEP implementation and credit revision across Maharashtra HEIs. These GRs lay out detailed guidelines for curriculum interventions for Four Year UG Engineering and other UG AICTE courses, B.A./ B.Sc./ B.Com. (and all Non-AICTE UG courses), and M.A./ M.Sc./ M.Com. (and all PG courses).

To foster holistic education, which encompasses hands-on experience, the focus of Government now turns towards strengthening the internship ecosystem through a formalized Internship Policy. This strategic move comes as a response to the NEP's call for students to engage with practical learning through internships and apprenticeships, a practice proven to enhance employability and refine skill sets.

- **Objective and Vision:** Internships serve as pivotal educational and career development opportunities, offering hands-on experience in specific fields or disciplines. They are structured, short-term, supervised Internships often centered around particular tasks or projects with predefined timeframes. An internship may be compensated, partially compensated, or unpaid; however, it must be meaningful and beneficial to both the intern and the hosting organization. Following are the objectives of the Internships envisaged for the students enrolled in State HEIs: • Exposing students to industrial environments that cannot be replicated in a classroom.

- Providing opportunities to acquire and refine analytical and managerial skills crucial for a professional career. • Offering hands-on experience in teamwork, thereby enhancing professional skills like communication, work ethics, conflict resolution, etc., with a lasting impact on lifelong learning and professional development. • Establishing links between students and potential future job or research opportunities.

- **Types of Internships:** Internships are an integral part of the academic curricula. Satisfactory completion of an internship is a mandatory requirement for the degree to be awarded by the HEI. Furthermore, considering the curriculum structure approved by the

HEI, multiple modes of internships are possible and are assigned academic credits within the curricula. The general idea is to enable students to undertake immersive assignments within the organizations for a limited period.

The following is a brief overview of credit requirements in line with GoM GRs, UGC, and AICTE4:

2. 12 credits of Internship activities may be accounted for UG Engineering (AICTE) courses.
3. 12-14 credits of Internship activities may be accounted for B.A., B.Sc., B.Com. and all Non-AICTE professional UG degree courses.
4. 10-12 credits of Internship activities may be accounted for M.A., M.Sc., M.Com. and all professional PG degree courses.

It must be noted that 1 credit is equivalent to minimum 30 hours of work. An intern is expected to spend 30 hours per week on Internship and related activities. Furthermore, Internships may be done through offline / online mode.

However, indicative requirement regarding Internship duration and credits for Four Year UG Engineering and other UG AICTE courses is as follows:

Internship	Schedule	Duration	Activities	Credits
Semester Integrated Internship	6 th / 8 th Semester	full-time across semester with other courses on online mode	Project work, Seminar, Industrial Training (excluding credits for Advanced Courses). This can be Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship / academic / industry research project	12

For B.A., B.Sc., B.Com. and all Non-AICTE professional UG degree courses, the indicative requirement regarding Internship duration and credits is as follows:

Internship	Schedule	Duration	Activities	Credits
Summers	After 4 th or 6 th Semester	4-8 weeks	Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship	8
Winters	After 3 rd / 5 th Semester	2-4 weeks	Inter/ Intra Institutional Activities, Research Project, Community Engagement	2-4
Semester Integrated	6 th / 8 th Semester	can be part-time- duration can be as per HEI's discretion	Project work, Seminar (excluding credits for Advanced Courses)	2-4

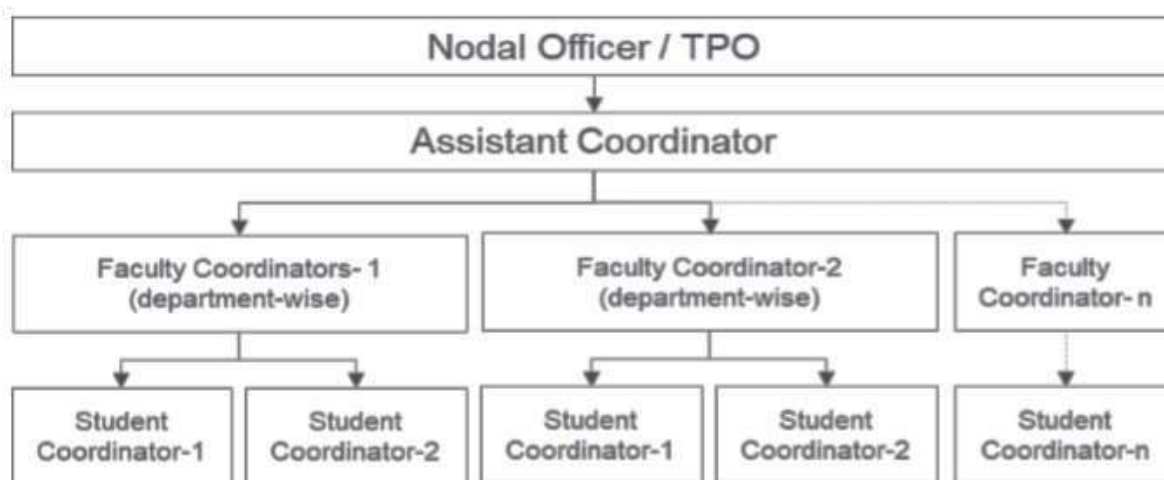
* Internship/Apprenticeship: 8 Credits + Field Projects/Community Engagement: 4-6 Credits For M.A., M.Sc., M.Com. and all professional PG degree courses, the indicative requirement regarding Internship duration and credits is as follows:

Internship	Schedule	Duration	Activities	Credits
Summers	After 2 nd Semester	4-6 weeks	Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship	4
Semester Integrated	3 rd & 4 th Semester	can be part-time- duration can be as per HEI's discretion	Project work, Seminar, Industrial Training (excluding credits for Advanced Courses). This can be Industrial/Govt./ NGO/MSME/ Rural Internship/ Innovation / Entrepreneurship / academic / industry research project	10-12

During the internship registration, the students are to notify their preference on whether they are seeking academic or industrial internships.

- **Internship Cell**

- **Governance Structure:** For every HEI, the Internship Cell shall be led by Internship Governing Council comprising of Vice Chancellor/Dean/Principal, Nodal Officer/TPO, and Assistant Coordinator(s). The Cell will further have Department-level Faculty Coordinators. Additionally, Student Coordinators shall be appointed from each Department by the nominated Faculty for efficient outreach to students. The following chart illustrates the Governance structure envisaged for the Cell:



It must be noted that:

- The Nodal Officer/TPO and Assistant Coordinators shall be appointed by the Vice Chancellor/Dean/Principal.
- Each HEI Campus will have an Assistant Coordinator reporting to Nodal Officer.
- The Nodal Officer shall report the progress and details of internships in each academic year to Vice Chancellor/Dean/Principal.

- **Duties and Responsibilities:** The Internship Cell shall be responsible for the proper functioning of the Internship processes at the HEI. The overall role of the Cell is of a facilitator and counselor for Internship related activities. The brief activities of the Cell would include:

 - The Cell shall work to identify projects linked to the local industry needs and create a pool available.
 - The Cell is responsible to conceptualize a digital portal where they can register experts, industries, organizations, mentors, faculty members which are visible to students.

Internship Cell shall maintain a uniform record-keeping mechanism. It shall also ensure that the evaluation rubrics are implemented as per the mandate of NEP, 2020, GRs released by Government of Maharashtra, and National Credit Framework by UGC.

- The cell shall streamline internship selection process including, but not limited to Resume Screening, PPTs, Tests, GDs, Interviews, etc.
- The Cell shall map students to student coordinators from the department. They are first point of contact in the Cell and would help throughout the process – answering all queries and managing the whole process.
- The Student Coordinators in consultation with the department/school-level faculty shall carry out the task of resume verification at the start of the academic session.
- Internship Cell shall make a sincere effort every year to bring in new companies in upcoming sectors to ensure better and more diverse opportunities for

students., the Cell shall make their best efforts in reaching out to the organizations preferred by students. • The Cell shall work towards connecting with the organization and signing MOUs with them on the behalf of HEI to establish long-term collaboration for providing internship. • The Cell shall organize preparatory events throughout the year. Information regarding the sessions will be provided to the students via mail and other

mediums. The Cell shall collate and share reference books, sample questions, mock test papers among students. • The Cell shall facilitate the onboarding of students for Internships, through online or offline medium, in line with Organization's requirements. • The Cell shall ensure protection of students in case of any offenses by the organizations. The Nodal Officer/TPO shall be the final arbiter on such matters.

Additional functions of the Internship Cell include arranging experts for student's personality development, improve communication skills, vocabulary, prepare students for resume preparation & email writing, group discussion, interview skills, aptitude training & practice tests, technical report writing, presentation skills, foreign languages proficiency etc.

The department-level Faculty Coordinators and student coordinators shall act as facilitators between HEI, recruiters and students. The team will be responsible for managing databases, facilitating and overseeing outreach, addressing Internship-related Q&As, understanding and reporting student preferences, and resolving queries with respect to the internships.

Additionally, a Mentor shall be identified by the Internship Cell or by each students through their network. The role of a Mentor shall be to provide professional/research guidance to the student during the internship. They shall also facilitate networking with other subject matter experts/professionals, which will enhance the internship experience and learning of the students.

The department-level Faculty Coordinator and Mentors will be nominated at the start of the academic year for each department. Student Coordinators will be elected by the students through the process laid down by the Nodal Officer/TPO. These Student Coordinators, upon satisfactory performance and contribution, shall be promoted to being Student Placement Coordinators in their later years of study.

○ **Organization Outreach:** The Cell, through the powers vested by Nodal Officer/TPO, shall reach out to the prospective companies in a formal and professional manner. The primary outreach shall be inclusive of following processes: • Development of Internship Brochure – soft copy as well as hard copy. • Preparing list of potential recruiters and past recruiters • Preferences mentioned by students in their Internship Undertaking

On these lines, the HEI is mandated to create Industry / academic linkages with organizations and institutions for establishing long-term partnership in recruiting interns. These linkages are to be made accessible on the University portal. The HEI shall further enable these potential recruiters to register on public platforms like AICTE for better visibility of opportunities across Maharashtra.

○ **Data Management:** The Cell shall maintain a uniform database for Internships at department-level and HEI level. The Cell shall have a restricted access to the database. It shall have detailed profiles of students, their contact details, prior education & experience, academic credentials, location / sectoral preferences, and internship status (companies shortlisted, awaiting response, internship offer, etc.). This database shall have a common skeletal framework and it shall be archived every academic year. Additionally, the data pertaining to Organization profiles shall be revised and updated with organization POCs and their coordinates.

• Internship	Guidelines	for	Students
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○ **Eligibility and Timeline** All the bonafide students enrolled in the HEI are eligible for internships, provided they have two or fewer backlogs at the start of the odd semester of the academic year. The HEI shall, at the start of each academic year, specify the timelines pertaining to undertakings, resume submission deadlines, resume proof-checking and verification, organizing outreach, and selection process.

○ **Internship Application**

3. The Internship Cell shall proactively inform the students when internship opportunities are floated along with the nature of internship, compensation structure, work mode/location, etc.
4. Interested students shall give their names to the department coordinators, who shall pass them on to the Assistant Coordinator with their resume.
5. Once the resumes are submitted to the organizations, the selection process shall start. The Cell will assist companies in scheduling pre-placement talks, tests, GDs, Interviews.
6. Students are to strictly adhere to the schedule such events

○ **Code of Conduct**

3. Each student is eligible to accept at most one Internship offer through the process. They would be deregistered from the process after receiving the offer.
4. Any off-campus opportunities given to the students must be reported to the HEI for subsequent procedures of relieving to take place in time.
5. Students are required to dress in formal clothing and footwear with a presentable persona throughout the selection process. Casual clothing will not be allowed during any part of the whole process.
6. If any student has any grievances with respect to termination and/or any penal action ordered by concerned HOD, then such student can submit his appeal in writing to the Nodal Officer/TPO, who shall be the final arbitrator on such matters.
7. After performing exceedingly well in the Internship, the student may be provided with a Pre-placement Offer (PPO). It needs to be accepted/rejected by the student within the deadline as set forth by the organization. A student who accepts the PPO will be considered "placed" and de-registered from the Placement process. If a student rejects a PPO, they can appear for further placements with the cell without any restrictions.

○ **Internship Evaluation**

After completion of Internship, students are to prepare a comprehensive report highlighting their learnings and takeaways during the internship period. The report shall be signed by the Internship Supervisor, Nodal Officer/TPO and Faculty Mentor.

The students are mandated to give a seminar based on the internship undertaken before an expert committee constituted by the concerned department, as per Performa for Evaluation of Internship (Appendix IX).

The internship shall be evaluated on the basis of performance, as reflected in the student log (Appendix V), Attendance record (Appendix VI), supervisor evaluation form (Appendix VII).

The assessment of internship will be based on the following criteria:

3. Quality and effectiveness of presentation
4. Depth of knowledge and demonstrated skills
5. Variety and relevance of learning experience

6. Practical applications and relationships with concepts taught in the course

7. Internship Report

Seminar presentation will enable sharing knowledge & experience amongst students & teachers and build communication skills and confidence in students. The weightage given to the Internship evaluation shall be as per the discretion of the concerned HODs and Nodal Officer/TPO. The credits will be allocated on the basis of overall grade (above Pass) received by the students during the assessment.

- **Appendix**
 - **Appendix I:**

Internship Undertaking

1. Student Name:			
2. Current Address			
3. Residence Address			
4. Email id			
5. Mobile Nos.			
6. Aadhar			
7. PAN			
8. Overall GPA			
9. Mode of Internship			
10. Internship Preferences			
	Location	Core Area	Organization / Institute
Preference-1			
Preference-2			
Preference-3			
confirm that I agree with the terms, conditions, and requirements of the Internship Policy Student Signature: Date:			
I confirm that the student has attended the internship orientation and has met all paperwork and process requirements to participate in the internship program, and has received approval from his/her mentor. Sign of Department Faculty Coordinator: Date :			

○ **Appendix II:****Draft Resume Template****Name:****Contact Number and Email ID:****Education:****HEI Name****Year**

Degree / Specialization:

CGPA:

HEI Name: <bachelor's degree>

Year

Degree / Specialization:

CGPA:

Internship / Work Experience

Organization**Year**

Project:

Brief:

Academic Experience

Semester**Year**

Project:

Brief:

3. Emphasize accomplishments that are relevant to the field
4. Be specific—omit unnecessary words and sentences
5. Start your sentence with an action verb, not a passive one Use past-tense verbs to show what you have accomplished Quantify results as much as possible
6. Use key words that will catch a recruiter's eye

Other Achievements and Personal Interests

7. List other achievements also in reverse chronological order
8. Leadership positions held outside of your formal work environment
9. Personal interests and accomplishments that will distinguish you from other applicants
10. Volunteer service/Social Work

○ **Appendix III:****Organization Outreach Letter**

<HEI Letter Head> To,
The (Manager, HR)

Subject: Request for _____ weeks internship of Students pursuing < >

Dear Sir,

The HEI established in <year>, <HEI>, Maharashtra reflects the vision of leading industrialists and educationalists. Institute is accredited with '< >' grade by NAAC in March 2015. The HEI has been recognized about it's over all academic excellence and infrastructure.

In view of the above, I request your good self to allow our following (no. of students) students for practical raining in your esteemed organization. Kindly accord your permission and give at least one-week time for students to join training after confirmation.

No.	Name	Roll no.	Year	Department

The resumes of these students are attached with this letter. If vacancies exist, kindly do plan for Interviews for the students in above branches.

A line of confirmation will be highly appreciated. Yours

sincerely,

Nodal Officer/TPO
<HEI Name and Date>

○ **Appendix IV:****Relieving Letter of Student**

<HEI Letter Head>

To,

The General Manager (HR)

.....

Subject: Relieving letter of student Dear

Sir,

Kindly refer your letter/e-mail dated. on the above cited subject. As permitted by your good self the following students will undergo Industrial Internship in your esteemed organization under your sole guidance and direction

No.	Name	Roll no.	Year	Department

This training being an essential part of the curriculum, the following guidelines have been prescribed in the curriculum for the training. You are therefore, requested to please issue following guidelines to the concerned student mentor.

4. Internship schedule may be prepared and a copy of the same may be sent to us.
5. Each student is required to prepare Internship diary and report.
6. Kindly check the Internship diary of the student daily.
7. Issue instruction regarding working hours during training and maintenance of the attendance record

You are requested to evaluate the student's performance on the basis of grading i.e. Excellent, Very Good, Satisfactory and Non-Satisfactory on the below mentioned factors:

8. Attendance and general behavior
9. Relation with workers and supervisors
10. Initiative and efforts in learning
11. Knowledge and skills improvement
12. Contribution to the organization

The performance report may please be forwarded to the undersigned on completion of training in sealed envelope.

Your efforts in this regard will positively enhance knowledge and practical skills of the students, your cooperation will be highly appreciated, and we shall feel obliged.

The students will abide by the rules and regulation of the organization and will maintain a proper discipline with keen interest during their internship. The students will report to you on dated.

..... along with a copy of this letter.

Yours sincerely,
Nodal Officer/TPO
<HEI Name and Date>

○ **Appendix V:**
 Student Diary (Log) Recording Format

Week	Date From - to	Task Assigned	Activities Performed	Key Learnings	Additional Remarks
1					
2					
3					
4					
5					
6					

Signature of Industry Supervisor

○ **Appendix VI:****Attendance Sheet**

<Organization Letter Head> Name

& Address of Organization

Name of the Student	
Roll Number	
Name of Course	
Date of Commencement of Training	
Date of Completion of Training	

Week	Mon	Thu	Wed	Thu	Fri	Sat
1						
2						
3						
4						
5						
6						

- Attendance Sheet should remain affixed in Daily Training Diary. Do not remove or tear it off.

3. Holidays should be marked in Red Ink in attendance column. Absent should be marked as 'A' in Red Ink.

Name and Signature with date of Internship Supervisor: _____

○ Appendix VII:

Supervisor or Evaluation of Intern

<Organization Letter Head>

Student Name: _____ **Date:** _____**Work Supervisor:** _____ **Title:** _____**Organization:** _____**Internship Address:** _____**Dates of Internship:** From _____ To _____

Please evaluate intern by indicating the frequency with which you observed the following behaviours:

Parameters	Needs Im- provement	Satisf- actory	Good	Excellent
Behaviors				
Performs in a dependable manner				
Cooperates with co-workers and supervisors				
Shows interest in work				
Learns quickly				
Shows initiative				
Produces high quality work				
Accepts responsibility				
Accepts criticism				
Demonstrates organizational skills				
Uses technical knowledge and expertise				
Shows good judgment				
Demonstrates creativity/originality				
Analyzes problems effectively				
Is self-reliant				
Communicates well				
Writes effectively				
Has a professional attitude				
Gives a professional appearance				
Is punctual				
Uses time effectively				

Overall performance of student intern (circle one): (Needs improvement / Satisfactory / Good / Excellent)

Additional comments, if any:

Signature of Industry supervisor _____

○ **Appendix VIII:****Student Feedback of Internship**

(To be filled by Students after Internship completion)

Student Name: _____ Date: _____

Industrial Supervisor: _____ Title: _____

Supervisor Email: _____ Internship is: _____ Paid _____ Unpaid _____

Organization: _____

Internship

Address: _____

Faculty Coordinator: _____ Department: _____

Dates of Internship: From _____ To _____

Give a brief description of your internship work (title and tasks for which you were responsible):

Was your internship experience related to your major area of study?

3. Yes, to a large degree
4. Yes, to a slight degree
5. No, not related at all

Indicate the degree to which you agree or disagree with the following statements.

Experience has:	Strongly Agree	Agree	No opinion	Disagree	Strongly Disagree
Given me the opportunity to explore a career field					
Allowed me to apply classroom theory to practice					
Helped me develop my decision-making and problem-solving skills					
Expanded my knowledge about the work world prior to permanent employment					
Helped me develop my written and oral communication skills					
Provided a chance to use leadership skills (influence others, develop ideas with others, stimulate decision-making and action)					
Expanded my sensitivity to the ethical implications of the work involved					
Made it possible for me to be more confident in new situations					
Given me a chance to improve my interpersonal skills					
Helped me learn to handle responsibility and use my time wisely					
Helped me discover new aspects of myself that I didn't know existed before					
Helped me develop new interests and abilities					
Helped me clarify my career goals					

OJT Guideline / Internship policy	NEP-2020 Implementation				
Provided me with contacts which may lead to future employment					
Allowed me to acquire information and/ or use equipment not available at my Institute					

6. In the Institute internship program, faculty members are expected to be mentors for students. Do you feel that your faculty coordinator served such a function? Why or why not?

7. How well were you able to accomplish the initial goals, tasks and new skills that were set down in your learning contract? In what ways were you able to take a new direction or expand beyond your contract? Why were some goals not accomplished adequately?

8. What areas did you most develop and improve?

9. What has been the most significant accomplishment or satisfying moment of your internship?

10. What did you dislike about the internship?

11. Considering your overall experience, how would you rate this internship? (Circle one). Satisfactory/ Good/ Excellent

12. Give suggestions as to how your internship experience could have been improved. (Could you have handled added responsibility? Would you have liked more discussions with your professor concerning your internship? Was closer supervision needed? Was more of an orientation required?)

<Signature of Student>

<Name, Roll number, Date>

○ **Appendix IX:****Performa for Evaluation of Internship by Institute**

<HEI Letter Head>

3. Name of Student _____**4. Mob. No.** _____**5. Roll No.** _____**6. Branch/Semester** _____**7. Period of Training** _____**8. Home Address with contact No.** _____**9. Address of Training Site:** _____**10.** _____ **Address of**
Training Providing Agency: _____**11.** _____ **Name/Designa**
tion of Training In- charge _____**12. Type of Work** _____**13. Date of Evaluation** _____**14. Please rate the following:**

S.no.	Particular	Grade
1	Quality and effectiveness of presentation	
2	Depth of knowledge and demonstrated skills	
3	Variety and relevance of learning experience	
4	Practical applications and relationships with concepts taught	
5	Internship Report	
6	Attendance record, student log, supervisor evaluation	

Overall grade: _____

Additional Remarks: Signature

of Faculty Mentor

