M. Sc. / M.A.
(MATHEMATICS)
In continuation of UG IVth year

Bundelkhand University, Jhansi

(New Education Policy-2020) w.e.f. 2022-23 and onwards

(SAURABH SHRIVASTAVA)

(Shri Alok Kumar Verma) (Prof R K Saini)

बुन्देलखण्ड विश्वविद्यालय, झाँसी
BUNDELKHAND UNIVERSITY, JHANSI Dated
Department of Mathematical Sciences and Computer Applications

Minutes of BOS Meeting

Today on 28th May 2022 from 12:15 PM onwards, a meeting of BOS (Board of Studies) for the session 2022-2023 as per New Education Policy (NEP-2020) for the courses BCA, B.Sc.(Mathematics/Statistics/Computer Science), M.Sc.(Statistics), MCA (As per AKTU), B.Sc. (CS & IT). M.Sc. (CS & IT) held in the department of Mathematical Science & Computer Applications, Bundelkhand University, Jhansi, UP. The following members present in the meeting:

1. Prof. R.K. Saini, BU Jhansi- HOD, Convener of BOS
2. Prof. Ravindra Patel RGPV, Bhopal- External Expert
3. Prof. Vijay Gupta, RGPV, Bhopal- External Expert
4. Prof. Avnish Kumar, BU Jhansi- Member
5. Dr. Alok Verma, BU Jhansi- Member
6. Dr. Saurabh Srivastava BU Jhansi- Member
7. Dr. Dharmendra Badal, BU Jhansi- Member
8. Dr. Dharmendra Kanchan, BU Jhansi- Member
9. Dr. D. Das Prajapati, BU Jhansi- Member
10. Dr. Anil Kevat, BU Jhansi- Member
11. Dr. Sachin Upadhyay, BU Jhansi- Member
12. Mr. Kamal Gupta, BU Jhansi- Member
13. Dr. Punit Matapurkar, BU Jhansi- Member
14. All Teaching Assistants, BU Jhansi- Member

After a through discussion, the following decisions are adopted:-

1. New Education Policy-2020 is adopted for the courses BCA, B.Sc.(Mathematics/Statistics/Computer Science). M.Sc.(Statistics). MCA(As per AKTU), B.Sc. (CS & IT), and M.Sc. (CS & IT), which will be effective session 2022-2023.
2. Panel of examiners for all courses running through the department are signed by members.
3. The syllabus of all the courses as BCA, B.Sc.(Mathematics/Statistics/Computer Science), M.Sc.(Statistics), MCA(As per AKTU), B.Sc. (CS & IT), and M.Sc. (CS & IT), takes a modification upto 20% form previous one, suggested by students and industry persons.
4. According NEP-2020, some value added courses, entrepreneurships programme and employability skill programme and courses are adopted.
5. Discussion for starting the course M.Sc.(Statistics with soft computing) in place of M.Sc.(Statistics) in the department from next academic session.
6. M.Sc in Data Science, will be the new course in the deptt from session 2022-23.

(Prof. R. K. Saini)
Head

campustech a portfolio company of TIMES INTERNET

Departmental Meeting- BU Jhansi

1. 1.1.2- 1.2.2- Syllabus revision/ CBCS implemention-2017-18 CBCS introduction can be shown as 100% syllabus revision provided the BOS date is within 1st June2017 to 31stMay. Nep Introduction can be shown as 100% syllabus revision provided the BOS 1st June 2021 to 31st August 2022. If any of the programmes does not fall under the purview of the above mentioned CBCS/ NEP introduction and syllabus has not been revised during assessment period i.e.,2017-18 to till date then include the action verbs in the syllabus as teaching methodology and make the BOS within 31st August 2022.

REMEMBER	UNDERSTAND	APPLY	ANALYZE	EVALUATE	CREATE
ARRANGE	ARRANGE	APPLY	ANALYZE	ASSESS	ARRANGE
CHOOSE	ASSOCIATE	BREAK DOWN	CALCULATE	CHOSE	ASSEMBLE
DEFINE	CLARIFY	CALCULATE	CATEGORIZE	CONVINCE	BUILD
DUPLICATE	DESCRIBE	COMPUTE	CLASSIFY	DEFEND	CHANGE
IDENTIFY	EXPLAIN	DEMONSTRATE	COMPARE	DISPROVE	COMPOSE
LABEL	IDENTIFY	DETERMINE	CONTRAST	EVALUATE	CONSTRUCT
LIST	INTERPRET	DRAMATIZE	DERIVE	JUSTIFY	DESIGN
MATCH	PARAPHRASE	EMPLOY	DIFFERENTIATE	PRIORITIZE	FORMULATE
NAME	OUTLINE	ILLUSTRATE	DISTINGUISH	PERSUADE	INFER
ORDER	REPHRASE	INTERPRET	DIVIDE	RANK	INVENT
RECITE	REVIEW	SCHEDULE	MODEL	SELECT	PREDICT
SELECT	SELECT	SKETCH	SIMPLIFY	VERIFY	PROPOSE
TELL	VISUALIZE	SOLVE	TEST	WEIGHT	SUPPOSE

2. 1.2.1- 1.1.3- New courses/employability- All syllabus copies to be provided to Campus Technology so that employability to be identified.
3. 1.3.4- Experiential Learning – all internal assignments to be shown as projects for all the students of the 2020-21 and 2021-22. 100% student participation to be shown either in field visit, internship and project.
4. 1.3.2-3.3.3- Add on course- All 5 years activities to be uploaded in the epaathsala portal for 5 years. All students should download the posto app and attend Value added coursed offered by Campus Technology:
   https://play.google.com/store/apps/details?id=com.epaathsala.Postonew

5. Feedback from students with respect to curriculum (only from final semesters), faculty and SSS from all semester students to bed completed immediately.
6. LMS to be implemented by all faculties within 21st July.
7. Mentor Mentee circular with reference no and logbook to be uploaded in the epaathsala portal for the 2021-22.
8. Remedial coaching policy to be framed. One completed Class session to be updated
9. OJT to be shown under placement .
10. All task to be completed by 21st July.

Semester wise titles of the paper in M.Sc./ M.A. Mathematics course

Year	Semester	Course Code	Paper Title	Compulsory/Elective	Internal	External	Total	credits	Cumulative minimum credits require for the award of the degree
Bachelor(Research) in Mathematics									
First Year **Bachelor (Research) in faculty**	**(After B.Sc.) VII / Equivalent to M.Sc. I Sem**	60651	Advanced Abstract Algebra	Compulsory paper I	25	75	100	5	28 In 15x28 =420 Hours
		60652	Real Analysis	Compulsory paper II	25	75	100	5	
		60653	Differential Equations	Compulsory paper III	25	75	100	5	
		60654	Integral equations	Compulsory paper IV	25	75	100	5	
			Minor Elective	Elective 1(a) (Interdisciplinary)	25	75	100	4	
		600655	Research Project/Industrial Training/Field Training		25	75	100	4	
				Total	**150**	**450**	**600**	**28**	
	(After B.Sc.) VIII / Equivalent to M.Sc. II Sem	60656	Topology	Compulsory paper I	25	75	100	5	24 In 15x24 =360 Hours
		60657	Complex Analysis	Compulsory paper II	25	75	100	5	
		60658	Differential Geometry	Compulsory paper III	25	75	100	5	
		60659	Numerical Analysis	Compulsory paper IV	25	75	100	5	
		600660	Research Project/Industrial Training/Field Training		25	75	100	4	
				Total	**125**	**375**	**500**	**24**	
	Grand Total VII and VIII Semester Or **Grand Total I and II Semester**				275	825	1100	28+24 =52	132*+52 = 184

Second Year	(After B.Sc.) IX / Equivalent to M.Sc. III Sem	70651	Number Theory	Compulsory paper I	25	75	100	5	24 In 15x24 =360 Hours
		70652	Mathematical Methods	Compulsory paper II	25	75	100	5	
			Elective	Choose from elective table-**1(a)**	25	75	100	5	
			Elective	Choose from elective table-**1(b)**	25	75	100	5	
		700659	Research Project/Industrial Training/Field Training		25	75	100	4	
				Total	**125**	**375**	**500**	**24**	
Master in faculty	(After B.Sc.) X / Equivalent to M.Sc. IV Sem	70661	Functional Analysis	Compulsory paper I	25	75	100	5	24 In 15x24 =360 Hours
		70662	Measure Theory	Compulsory paper II	25	75	100	5	
			Elective	Choose from elective table-**1(c)**	25	75	100	5	
			Elective	Choose from elective table-**1(d)**	25	75	100	5	
		700669	Research Project/Industrial Training/Field Training		25	75	100	4	
				Total	**125**	**375**	**500**	**24**	
		Grand Total IX and X Semester Or Grand Total III and IV Semester			250	750	1000	24+24=48	184+48=232

Semester wise titles of the paper in PGDR/Doctor of Philosophy in mathematics

Year	Semester	Course Code	Paper Title	Compulsory/Elective	Internal	Externa l	Total	credits	Cumulative minimum credits require for the award of the degree
	PGDR in mathematics								
	XI	-	Paper I	Elective paper I	25	75	100	6	16 In 15x16 =240 Hours
		-	Paper II	Elective paper II	25	75	100	6	
		-	Research Methodology	Compulsory Paper III	25	75	100	4	
			Research Project/Industri al Training/Field Training	Qualifying	25	75	100	1	232+16= 248
Doctor of Philosophy in Mathematics									
	XII - XVI			**Ph.D. Thesis**					

Elective papers: The student(s) shall select any twosubject from the following as minor subject from any other faculty (expect own faculty)

Elective Table no-1(a) (Third Semester)

S. No.	Paper Code / Paper name
1	70653 Fluid Dynamics
2	70654 Mathematical Statistics
3	70655 Advance Operation Research

Elective Table no-1(b) (Third Semester)

S. No.	Paper Code / Paper name
1	70656 Graph Theory
2	70657 Special Function
3	70658 Java Programming

Elective papers: The student(s) shall select any twosubject from the following as minor subject from any other faculty (expect own faculty)

Table no-1(c) (Fourth Semester)

S. No.	Paper Code / Paper name
1	70663 Partial Differential Equations
2	70664 Theory Relativity
3	70665 Bio-Mathematics

Table no-1(d) (Fourth Semester)

S. No.	Paper Code / Paper name
1	70666 Theory of Queues
2	70667 Theory of Fuzzy Sets and Applications
3	70668 Numerical Solution of ODE & PDE

ORDINANCE FOR POSTGRADUATE (SEMESTER SYSTEM) PROGRAMME ARTS, SCIENCE & COMMERCE FACULTIES (2022 onward)

1. INTRODUCTION

1.1 Preamble

This ordinance governs all the rules and regulations as per the NEP 2020 for the traditional post graduate programs (M.A. / M.Sc.(Mathematics) which are not covered by any regulatory bodies (AICTE, BAR Council, PCI, NCTE etc) running in the (Department of Mathematical Sciences & Computer Applications), University campus or its affiliated colleges in Bundelkhand University, Jhansi. This ordinance supersedes all the previous relevant ordinances, rules and regulations.

1.2 Duration

Bundelkhand University has adopted the semester system in various Postgraduate courses as per directives of Higher Education Department, Uttar Pradesh Government vide letter No 401/seventy-3-2022 dated 09-02-2022 to accelerate the teaching-learning process and enable vertical and horizontal mobility in learning from the academic session 2022- 23 onwards.

The duration of PG courses shall be two years comprising of four semesters. In case a student(s) exits from this programme after completion of the first year (2 semesters),he /she may take exit from the programme and shall be awarded the Degree of Bachelor in Research. After the successful completion of two years (4 semesters) a student shall be awarded the Master's degree in the concerned subject. The maximum duration to complete the course shall be four years.

1.3 Eligibility for Admission

- Candidate, who wishes to seek admission in a course of study prescribed for a post graduate degree of the University, shall be admitted to campus or an affiliated college unless he/ she has:

  -passed the three years Bachelor's degree course Examination of the University of Uttar Pradesh or any other Indian University incorporated by any law in force at the time of admission.
  or
  -passed any other equivalent examination recognized by the University as equivalent thereto.
  -passed any other equivalent examination recognized by a Foreign University as equivalent thereto

- The date of admission shall follow the University academic calendar.

1.4 Choice of Subject and Course Structure

i. University/ College shall admit students as per the eligibility criteria and availability of seats decided by the university.

ii. A student shall take admission to post graduation first year of fourth year of Higher Education program of NEP 2020 after successful completion of

Graduate course from NEP 2020 or old course of Science/ Arts/ Commerce/ Management, etc. He/she shall have to choose respective faculty courses as per guidelines of NEP 2020 depending on the number of seats available in concerned subject and eligibility criteria. In case a candidate is willing to change the faculty, the following condition is required-

The candidate should have passed Bachelor degree in Science/ Commerce of NEP 2020 or old courses may take admission in some subjects of Arts faculty (excluding practical subjects like geography, psychology etc). Similarly, the Student from Commerce of NEP or old course of commerce may also be eligible to take admission in Arts subjects. Arts, Management and Commerce candidates cannot be admitted in Science subjects.

iii. Student(s) shall select subjects for Post graduation course from the major subjects that he / she had opted in the graduation course and shall continue with the same subjects in all the four semesters of the PG programme.

iv. The course structure shall be as follows:

There shall be four compulsory theory papers in the first semester. In the second and third semester there shall be two compulsory papers and one/two elective papers. The elective papers are the specialization papers.

Student(s) shall have to select one Minor Elective Course as **Minor subject** from any other faculty (except own faculty) or interdisciplinary subject in the first semester of the first year.

v. Student(s) shall take a Research Project /Survey/ Industrial /Field training program in both the years (Semester II and IV). No pre-requisite shall be required for this.

vi. List of Minor Elective Course: The candidate shall select any one subject from the following as minor subject in first year of post graduate course.

1(a)

S No	Science	Arts	Commerce	Interdisciplinary
1.	Mathematical Biology	Tribal Culture and Heritage	Customer Relation Management	Ancient Medical Sciences
2.	Conservation and Water Resource Management	Principle of Administration and Implications	House Keeping and Hospitality	Traditional Medical Therapy
3.	Natural Resources and Conservation	Socio-Economics and Social Security	Share Market and Banking	Vedic Mathematics
4.	Pollution: Causes and Mitigation	Archeological Sites and Monuments	Retail Management and Accounting	Bio Medical Instrumentation and Health
5.	Computational Resources	Indian Constitution	Insurance Policy and Finance	Disaster, Mitigation, & Management
6.	Organic and Natural Farming	Communication and Soft Skill		Mining Plan and Resource Mapping
7.	Computer Hardware Handling	Sanskrit Knowledge System		Water Treatment System

8.	Computer Software Handling	Technical Translation and Trans creation		Climate Change and Environmental Degradation
9.	Solar and Non Conventional Energy	Urban Economics and Planning		Medicinal and Aromatic Plants Cultivation, extraction and nutraceutical Values
10.	Cyber Crime	Actuarial Economics		
11.	Bee Keeping, Aquaculture and Fish Farming	Social Sector and Gender Economics		Non Conventional Energy Resource
12.	Entrepreneurship in Microbial and Botanical Products	Environmental Economics		Soil and Water Testing
13.				

2. SEMESTER AND CREDIT DISTRIBUTION

An academic year for post graduate program is divided into four semesters. The Odd semester may be scheduled from July to December and Even semester from January to June.

Fourth Year

	VII Sem	Credits	VIII Sem	Credits
Major	Theory – 04 Papers Or Theory – 04 Papers Practical -02	5 Credits each Total Credits=20 Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 **Total Credits=20**	Theory – 04 Papers Or Theory – 04 Papers Practical -02	5 Credits each Total Credits=20 Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 **Total Credits=20**
Minor	Minor Elective-1 paper of 04 credits	04 Credits **Total Credits=04**		
Research Project/ Industrial training/ Survey/ Field Training	One of each 04 Credits	04 Credits **Total Credits=04**	One of each 04 Credits	04 Credits **Total Credits=04**
Total Credits		28		24
Total in Both Semester				**52 Credit**

Fifth Year

Semester	IX	Credits	X	Credits
Major	Theory – 04 Papers Or Theory – 04 Papers Practical -02	5 Credits each Total Credits=20 Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 **Total Credits=20**	Theory – 04 Papers Or Theory – 04 Papers Practical -02	5 Credits each Total Credits=20 Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 **Total Credits=20**
Research Project / Industrial training / Survey	One of each 04 Credits	04 Credits **Total Credits=04**	One of each 04 Credits	04 Credits **Total Credits=04**
Total Credits		24		24
Total in Both Semester	**48 Credit**			

3. ATTENDANCE

The expression "a regular course of study" wherever it is used in these Ordinances, means attendance of at least 75% of the lectures and other teaching in campus / affiliated college in the subject for the examination at which a candidate intends to appear and at such other practical work (such as work in a laboratory) as is required by any Statute, Ordinance or Regulation in force for the time being in the University.

A shortage up to 5% of the total number of lectures delivered or practical work done in each subject may be condoned by the Principal of the college/ Head of the Department (in case of University Campus) concerned.

A further shortage up to 10% may be condoned only by the Vice- Chancellor on the specific recommendation of the Principal of the college/Head of the Department concerned (in case of University Campus).

4. EXAMINATIONS

1. There shall be examinations at the end of each semester as, for odd and even semesters in accordance with the academic calendar of the university. A candidate who does not pass the examination in any course(s) shall be permitted to appear in such failed course(s) in the subsequent examinations upto the maximum duration of the course.

2. A candidate should get enrolled/ registered for the first semester examination and is mandatory. If enrolment/ registration is not possible owing to shortage of attendance / rules prescribed OR belated joining or on medical grounds, such students shall not be permitted to proceed to the next semester. Such students shall re-dothe first semester in the subsequent term of that semester as a regular student; however, a student of first semester shall be admitted in the second semester, if he/she has successfully completed the first semester.
3. It shall be mandatory for the student(s) to register for examination in each and every semester (i.e. to fill up the examination form with the requisite fee). If a student fails to register for the examination in any semester, he or she shall not be allowed to appear in that semester as a back paper student. Such student(s) shall appear in the (next) subsequent examination of that semester.

5. EVALUATION

The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade point. Evaluation for each course shall be done by a Continuous Internal Assessment (CIA) by the concerned course teacher as well as by end semester examination and will be consolidated at the end of course. The evaluation must be continuous and holistic and should be based on following parameters:

i. Academic assessment
ii. Skill assessment
iii. Physical assessment
iv. Personality assessment
v. Extra-curricular assessment

5.1 THEORY PAPER

Semester Examinations shall be conducted by the university as mentioned in the academic calendar. The Question paper will be set by the examiners appointed by the Vice Chancellor based on the recommendation of the board of studies. The pattern of the question paper shall be as given in annexure II.

i. Internal Assessment(C.I.A.) –25%weightageofacourse

- Test/ Mid-Term Assessment - 10 marks
- Term paper/Presentation on given project/assignment - 10marks
- Attendance/activities – 05marks

ii. End Semester Exam (External examination)– 75% weightage of course

5.2 PRACTICAL PAPER

Practical examinations will be conducted by the examiners appointed by the Vice Chancellor on the recommendations of the Board of Studies. Each student has to present the practical records.

i. Internal Assessment(C.I.A.) –25%weightageofacourse

- Test/ Mid-Term Assessment - 10 marks
- Term paper/Presentation on given project/assignment - 10marks
- Attendance/activities – 05marks

ii. End Semester Exam (External examination)– 75% weightage of a course

MINIMUM PASSING STANDARD

1. The minimum passing standard for combined external and internal examinations for each subject/paper shall be 45%,i.e. 45 out of 100 marks for theory and practical courses. The minimum passing standard for Aggregate in a semester end Examination shall be 45%.
2. Continuous Internal Assessment (CIA) shall be ensured by the Principal of the colleges / HODs for the Campuses courses. The Principal of the colleges / HODs of the Campus shall provide the marks of the same to the university and it shall be mandatory to maintain the records of the same till the maximum duration of that course.
3. The internal assessment, field training and practical examination awards of a student who fails in any semester examination shall be carried forward to the next examination.
4. It shall be mandatory for a student to secure minimum 45% marks (i.e. 34/75) in the theory and practical paper separately.

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PROVISION FOR BACK PAPERS AND EX-STUDENTS

A Back Paper (B.P.) candidate shall be promoted to next semester. The back paper facility in a semester provides promotion to the next semester and another opportunity to obtain a minimum of the pass marks assigned for an individual paper or in the aggregate. Following category of students of Bundelkhand University shall be eligible for back paper facility as under,

1. A student shall be required to pass in minimum two subject papers in each semester. However, at the end of each year, it shall be mandatory for a student to pass in at least two subjects papers and minor paper otherwise he/she shall be deemed as failed and will be treated as a year back / ex- student.

5. Students shall get the attempts to appear in the Back paper examination in the subsequent odd /even semester till the maximum duration of the said course.

6. Special back paper examination shall be held only for regular students of the final year of PG course.
7. The candidates who fail in more than three of the total papers, will be deemed as failed. These candidates can appear only in subsequent examination of that semester as Ex- Students.

8. PROMOTION RULES

8.1Semester Course & Examination:

The students who have taken admission in any post-graduation programme in a session and who have put in the minimum percentage of attendance for appearing at the Examination, presented himself/herself for internal assessment and have filled in the examination form in time for appearing at the End Semester Examination shall be allowed to appear at the respective examinations.

8.2Declaration of results

After appearing in the Examination of both the semesters in a particular year, the student can be put in the following categories in the context of declaration of the results of the Semester Examination:

Passed
Promoted with Back Paper(s)
Failed

8.3 Promotion to next Semester:

All students under category Passed and promoted with back papers shall be promoted to the next Semester.

"Failed" students may clear their UNCLEARED courses in subsequent examinations as ex-students.

Students promoted with back papers shall clear their back papers in subsequent examinations as ex-students.

A student who has failed in a course shall get two more chances to clear this course subject to the maximum duration for passing the course. Further, each candidate shall have to clear all the courses within the maximum period of seven years from the date of his/her latest admission.

A candidate who has qualified for the Degree shall be placed in the First / Second Division as per following table:

8. COMPUTATION OF SGP AND CGPA

The guidelines formulated by Bundelkhand University shall be followed in order to bring uniformity in evaluation system of every CBCS based Course and computation of the SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average)based on students' performance in examination. The number of core, elective, open elective papers and foundation papers and the required credit for each paper shall be formulated by respective Board of Studies (BOS) and faculty board. For the purpose of computation of work load the UGC proposed mechanism is adopted i.e. one credit=1 Theory period of one hour duration, 1credit= 1Tutorial period of one hour duration, 1credit=1 Practical period of one hour duration. The credit(s) for each theory paper/practical/tutorial/dissertation will be as per the respective Board of Studies of departments.

Letter Grade	Numerical grade
O (outstanding)	10
A+ (Excellent)	9
A(very good)	8
B+(Good)	7
B(average)	6
F(Fail)	<5
Ab (Absent)	0

The minimum passing marks shall be 45%of the maximum marks as prescribed in the University Examination and 45%of marks in the aggregate marks in the subject including internal / sessional marks.i.e. Minimum Passing Grade is "B".

A student who obtains Grades "O" or "B" shall be considered as PASSED. If a student secures "F" grade, he/she shall be considered as FAILED and shall have to re appear in the examination. It is mandatory for a student to earn the required SGPA as in each semester. If a student is not able to secure 45% / B grade in any theory / practical / internal / sessional / viva-voce / internship / project examination, the awarded grade point shall be ZERO (0).

9.1 The University, adopts absolute grading system where in the marks are converted to grades, and every semester results will be declared with semester grade point average(SGPA) and year result will be declared with year grade point average (YGPA). The Cumulative Grade Point Average (CGPA) will be calculated in end of final semester. The grading system except pharmacy department will be with following letter grades and grade points scale as given below:

Table

Level	**Outstanding**	**Excellent**	**Very Good**	**Good**	**Average**	**Fail**
Letter Grade	**O**	**A+**	**A**	**B+**	**B**	**F**
Grade Points	**10**	**9**	**8**	**7**	**6**	**0**
Score (Marks) Range (%)	**≥90 (90-100)**	**<90, ≥80 (80-89.99)**	**<80, ≥70 (70-79.99)**	**<70, ≥60 (60-69.99)**	**<60, ≥45 (50-59.99)**	**<45 (0-35.99)**

1.1 A student obtaining Grade "F" shall be considered failed and will be required to reappear in the examination. Such students after passing the failed subject in subsequent examination / will be awarded with grade respective of marks he/she scores in the subsequent examination/s.

1.2 The University has the right to scale/moderate the theory exam / practical exam / internal exam / sessional marks of any subject when ever required for converting of marks into letter grades on the basis of the result statistics of university as in usual practice, i.e. marks obtained in decimal will be converted in nearest integer.

9. CONVERSION OF GRADES IN TO PERCENTAGE

1.3 Conversion formula for the conversion of CGPA into Percentage is **CGPA Earnedx10= Percentage of marks scored.**

Illustration: CGPA Earned8.2 x10=82.0%

2. AWARD OF DIVISION

Division shall be awarded only after the final semester examination based on integrated performance of the student for all the semesters as per following details.

2.1 A student who qualifies for the award of the degree securing "B" or above grades in all subjects pertaining to all semesters, and in addition secure as a CGPA of 8.0 and above shall be declared to have passed the examination in **FIRST DIVISION WITH HONOURS**.

2.2 A student who qualifies for the award of the degree securing "B" or above grades in all subject pertaining to all semesters, and in addition secures a CGPA of 7.0 and above shall be declared to have passed the examination in **FIRST DIVISION**.

2.3 A student who qualifies for the award of the degree securing "B" or above grades in all subjects pertaining to all semesters, and in addition secures a CGPA of 5.0 and above shall be declared to have passed the examination in **SECOND DIVISION**.

10. UNFAIR MEANS:

Cases of unfair means in the End Semester Examinations and Mid-Term Tests shall be dealt as per the rules laid by the University.

Note:

1. Those students who are NOT eligible for promotion to next year shall have to reappear in the coming examination as ex-students. However, the marks of internal assessment shall be carried forward in such cases.

2. Scrutiny facility and Challenge evaluation facility shall be available for those students who want to improve their grades.

M.A.

M.Sc (Mathematics)/First Semester Paper

Syllabus and Teaching Plan

Advanced Abstract Algebra		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Symmetric Group**	**Total Lec= 18**
I. 1	Homomorphism and isomorphism of group	2=1(L) +1(T)
I. 2	Lagranges theorem, Euler's theorem, permutations of group.	3=2(L)+1 (T)
I. 3	Fermats's theorem, Fundamental theorem on homomorphism of groups	5=3(L)+2 (T)
I. 4	Maximal normal subgroup, solvable group	3=2(L)+1 (T)
I. 5	Jordan Holder theorem, external direct product and it's theorem	5=3(L)+2 (T)
II	**Ring, Integral Domain, Field**	**Total Lec= 19**
II. 1	Ring with unity, commutative ring, ring with zero divisor.	2=1(L)+1 (T)
II. 2	Integral domain, skew field(division ring), field.	3=2(L)+1 (T)
II. 3	Theorem on subring related with necessary and sufficient condition, intersection of two subring again a subring,	5=3(L) +2(T)
II. 4	Division algorithm for polynomials over a field	3=2(L)+1 (T)
II. 5	Unique factorization domain, Remainder theorem.	2=2(L)
II. 6	Quotient field, finite fields, Modules	2=1(L)+1 (T)
II. 7	Homomorphism of modules or linear Transformations, quotient modules	2=2(L)
III	**Ideals**	**Total Lec=19**
III. 1	Improper ideals and proper ideals, Principal ideal,prime ideal , maximal ideal	3=2(L)+1 (T)
III.2	Ring of integer is a principal ideal ring,	6=3(L) +3(T)
III. 3	Intersection of two ideals in an ideal, a field has no proper ideal, a division ring is simple ring	4=3(L)+1 (T)
III. 4	Commutavtive ring with unity is a field if it has no proper ideal, theorem base on commutative ring with ideal.	2=1(L) +1(T)
III.5	Theorem based on commutative ring with principal ideal, ring of integer is principal ideal domain.	3=2(L)+1 (T)
III. 6	An ideal 'S' or ring of integers 'R' is maximal iff 'S' is generated by some prime integer.	2=2(L)
IV	**Conjugate elements and class equations of finite groups.**	**Total Lec= 11**
IV. 1	Sylow P-subgroup, Sylow theorem.	5=3(L)+2 (T)
IV. 2	Theorem related with finite subgroups of a group 'G'	3=3(L)
IV. 3	Cauchy theorem of finite abelian group, Sylow theorem for abelian groups,	4=2(L)+2 (T)
V	**Elements of Galois Theory**	**Total Lec= 7**
V.1	Galois group, Galois field, theorem on $O[G(K,F)]\leq[K,F]$, finite field having the same number of the elements are isomorphic, Galois fundamental theorem,	5=3(L)+2 (T)
V.2	A cube twice the volume of the unit cube is not constructible by ruler.	2=1(L)+1 (T)
VI	**Characteristic of field , field extensions**	**Total Lec=16**
VI.1	Dgree of field extension, algebraic field extension, monic polynomial	3=2(L)+1 (T)
VI.2	Theorem based on $[L:F]=[L:K][K:F]$,	3=3(L)
VI.3	State and proof Remainder theorem,	2=2(L)
VI.4	State and proof factor theorem	2=1(L)+1 (T)
VI.5	Any finte extension of a field is an algebraic extension of the field., a field 'F' is called perfect field if all finite extension of 'F' are separable.	3=2(L)+1 (T)
VI.6	Theorem based on finite extension of 'F',	3=2(L)+1 (T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books :

(1)Topics in algebra , I. N Herstein

(2) Abstract algebra, John A. Beachy and Wiliam D. Blairr

Differential equations		L T P 60 30 00
Unit No.	Unit Name	Expected number of teachings days 90
I	**Basic Concepts**	**Total Lec=10**
I. 1	Origins and formulation,	2= 1(L)+1(T)
I. 2	Order and degree	2= 1(L)+1(T)
I. 3	Linear and nonlinear	2= 1(L)+1(T)
I. 4	Solution of a differential equation	2= 1(L)+1(T)
I. 5	Wronskian	2= 1(L)+1(T)
II	**Differential equation of first order and first degree**	**Total Lec= 17**
II. 1	Equations in which variables are separated	2= 1(L)+1(T)
II. 2	Homogeneous equation	2= 1(L)+1(T)
II. 3	Reducible to homogeneous	2= 1(L)+1(T)
II. 4	Linear differential equations	2= 1(L)+1(T)
II. 5	Reducible to linear form	2= 1(L)+1(T)
II. 6	Exact differential equation	2= 1(L)+1(T)
	Change of variables	2= 1(L)+1(T)
II. 7	Integrating factor	1= 1(L)
III	**Differential equation of first order and but not of first degree**	**Total Lec= 11**
III. 1	Solvable for p	2= 1(L)+1(T)
III.2	Solvable for x	2= 1(L)+1(T)
III. 3	Solvable for y	2= 1(L)+1(T)
III. 4	Homogeneous equation	2= 2(L)
III.5	Clairaut's equation	3=2(L)+1(T)
IV	**Second order equations**	**Total Lec=23**
IV. 1	Complete solution in terms of a known integral	5=4(L)+1(T)
IV. 2	Removal of first derivative	2= 1(L)+1(T)
IV. 3	Transformation of the equation by changing the independent variable	3=2(L)+1(T)
IV.4	Method of Variation of parameters	3=2(L)+1(T)
IV.5	Singular Solutions	3=2(L)+1(T)
IV.6	Simultaneous equations	3=2(L)+1(T)
IV.7	Total differential equations	4=2(L)+2(T)
V	**Initial and boundary value problems**	**Total Lec= 7**
V.1	Existence and uniqueness theorem	5=4(L)+1(T)
V.2	Strum- Liouvilleequatiuon	2=2(L)
VI	**Series Solutions**	**Total Lec=12**
VI.1	Series solution of a differential equations	4=3(L)+1(T)
VI.2	Legendre's Function	4=3(L)+1(T)
VI.3	Bessel's Function	4=3(L)+1(T)
VII	**Solution ofLaplace, Heat and Wave equations using the method of separation of variables**	**Total Lec=10**
VII.5	Laplace Equation	4=3(L)+1(T)
VII.6	Heat Equation	3=3(L)
VII.7	Wave Equation	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

1. Differential Equation by Simmons G.F
2. Introduction of Ordinary Differential Equations by Rabenstein
3. Theory of Ordinary Differential Equation by Coding E.A.

Real Analysis

	L	T	P
	60	30	00

Unit No.	Unit Name	No. of Teachings days 90
I	**Basic concept of set theory, Real Number System**	**Total Lec= 17**
I. 1	Completeness property in 'R'	2=1(L)+1(T)
I. 2	Countable and uncountable sets	3=2(L)+1(T)
I. 3	Limit point, open set closed set, dense sets,	5=3(L) +2(T)
I. 4	Neighbourhood of a set	3=2(L) +1(T)
I. 5	Bolzano Weiertrass theorem	4=2(L)+ 2(T)
II	**Extended real number system**	**Total Lec= 20**
II. 1	Limit and continuity of real function and their properties	3=2(L)+1(T)
II. 2	Continuity and Compactness	3=2(L)+1(T)
II. 3	Continuity and Connectedness	5=3(L)+ 2(T)
II. 4	Discontinuity of different kind	2=2(L)
II. 5	Discontinuity of Functions, Derivability	2=2(L)
II. 6	Example based on continuity, connectedness	2=1(L)+1(T)
II. 7	Example based on discontinuity	3=2(L)+1(T)
III	**Mean value theorem**	**Total Lec= 19**
III. 1	Derivatives, Derivativeness of higher order and continuity of Taylor Theorem	2=2(L)
III.2	Fundamental theorem on integral calculus	6=3(L) +3(T)
III. 3	Taylors theorem for function of two variablez	4=2(L)+2 (T)
III. 4	Example based on fundamental theorem on integral calculus	2=2(L)
III.5	Illustrative example on Taylors theorem	3=2(L)+1(T)
III. 6	Illustrative example on mean value theorem.	2=1(L)+1(T)
IV	**R-S integrals**	**Total Lec= 11**
IV. 1	Basic definition's of Riemann integral	5=3(L)+2 (T)
IV. 2	Integrability of continuous and monotonic functions	2=2(L)
IV. 3	Some example on R-S integrals problem	4=2(L)+2 (T)
V	**Sequencing and scheduling**	**Total Lec= 7**
V.1	Processing of jobs through machines	5=3(L)+ 2(T)
V.2	Example based on sequencing problem	2=2(L)
VI	**Definition and existence of the integral, Integral as a limit of sum**	**Total Lec=16**
VI.1	Improper integrals and their convergence	3=2(L)+1 (T)
VI.2	Comparision text, mu-test, Abels test	3=2(L) +1(T)
VI.3	Drichlets test	2=2(L)
VI.4	Integral as aparameter and its differentiability and integrability	2=2(L)
VI.5	Example on R-S integrals	3=2(L)+1 (T)
VI.6	Example on proper and improper integrals	3=2(L)+1 (T)

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Each Teaching shall consist of 60 minutes time duration.

Reference Books:

(1) Real and Complex analysis : Walter Rudin
(2) Introduction to real analysis: Robert G. Bartle

Integral Equation		L T P 60 30 00
Unit No.	Unit Name	No. of Teachings days 90
I	**Linear integral equation**	**Total Lec= 16**
I. 1	Fredholm integral equation	3=2(L)+1(T)
I. 2	Volterra integral equation	4=2(L)+2(T)
I. 3	Special kinds of kernels	3=2(L)+1(T)
I. 4	Leibnit'z rule of differentiation under integral sign	4=2(L)+2(T)
I. 5	Formula for converting a multiple integral into a single ordinary integral	2=2(L)+1(T)
II	**Conversion of ordinary differential equations into integral equations**	**Total Lec=20**
II. 1	Introduction	2=2(L)
II. 2	Initial value problem	4=3(L)+1(T)
II. 3	Method converting an initial value problem into a volterra integral equation	3=2(L)+1(T)
II. 4	Boundary value problem	2=1(L)+1(T)
II. 5	Method converting an initial value problem into a Fredholm integral equation	5=3(L)+2(T)
II. 6	Alternative method and formulae	2=2(L)
II. 7	Problems	2=2(L)
III	**Homogeneous Fredholm Integral equation second kind**	**Total Lec=16**
III. 1	Definition and threoms	4=3(L)+1(T)
III.2	Characteristic values and characteristic function	2=1(L)+1(T)
III. 3	Topic based problem	2=1(L)+1(T)
III. 4	Separable kernels	2=1(L)+1(T)
III.5	Degenerate kernels	2=1(L)+1(T)
III. 6	Topic based preolems	2=1(L)+1(T)
IV	**Method of successive Approximation**	**Total Lec=10**
IV. 1	Iterated kernels or function	4=3(L)+1(T)
IV. 2	Reciprocal functions	3=3(L)+1(T)
IV. 3	Topic based problem	3=1(L)+2(T)
V	**Neumann series**	**Total Lec=8**
V.1	Topic based theorems and formulae	5=3(L)+1(T)
V.2	Exercise	3=2(L)+1(T)
VI	**Symmetric kernels and Green theorem**	**Total Lec= 20**
VI.1	Symmetric kernels & regularity conditions	4=3(L)+1(T)
VI.2	Hilbert-Schmidt theorem	2=2(L)
VI.3	Reisz-Fischer's theorem	5=3(L)+2(T)
VI.4	Some useful results	3=3(L)
VI.5	Green Theorem	4=2(L)+2(T)
VI.6	Topic based problems	2=1(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1). Linear Integral Equation by W.W. Lovin

(2). An Analysis of Linear Integral Equations by J.A Cochram

Minor Elective: Thestudent(s) shall select any one subject from the following as minor subject from any other faculty (except own faculty)

S. No	Science	Arts	Commerce	Interdisciplinary
1	Mathematical Biology	Tribal Culture and Heritage	Customer Relation Management	Ancient Medical Science
2	Conservation and water resource management	Principle of administration and implications	Housekeeping and hospitality	Traditional medical therapy
3	Natural Resources and conservation	Socio-Economic and social security	Share Market and Banking	Vedic Mathematics
4	Pollution Causes and mitigation	Archeological sites and monuments	Retail management and accounting	Bio Medical Instrumentation and health
5	Computational Resources	Indian Constitution	Insurance Policy and Finance	Disaster Mitigation and Management
6	Organic and Natural Farming	Communication and soft skills		Mining Plan and Resource Mapping
7	Computer hardware Handling	Sanskrit Knowledge system		Water treatment system
8	Computer Software Handling	Technical Translation and Tran creation		Climate Change and environmental degradation
9	Solar and non conventional energy		Urban economics and planning	Medicinal and aromatic plants cultivation, extraction and nutritional values
10	Cyber Crime		Actuarial economics	
11	Bee Keeping, aquaculture and fish farming		Social sector and gender economics	
12	Entrepreneurship in microbial and botanical products		Environmental economics	Soil and water testing

M.A.

M.Sc/(Mathematics) Second Semester Paper

Syllabus and Teaching Plan

Topology		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Elements of Topological spaces**	**Total Lec=17**
I. 1	Basic properties of Topological spaces	2=2(L)+1(T)
I. 2	connected & disconnected set Component	3=2(L)+1(T)
I. 3	Separable spaces	5=3(L)+2(T)
I. 4	Elements of Topological spaces	3=2(L)+1(T)
I. 5	Elements with connected spaces	4=2(L)+2(T)
II	**Connected and disconnected spaces**	**Total Lec= 20**
II. 1	Some basic property of disconnected spaces	3=2(L)+1(T)
II. 2	Subspace of real line is connected, Union with subset's of topological space	3=2(L)+1(T)
II. 3	Locally connected spaces	5 =3(L)+2(T)
II. 4	Compact spaces	2=2(L)
II. 5	Compact spaces and its Theorem's	2=2(L)
II. 6	Theorem based on component of topological space	2=2(L)
II. 7	Multiple connected spaces, with it'stheorem	3=2(L)+1(T)
III	**Compactness in metric spaces**	**Total Lec=19**
III. 1	Compact set, Lindelof space, Locally compact, Para compact	2=1(L)+1(T)
III. 2	Hausdorff-space, Theorem on Hausdorff space	6=3(L)+3(T)
III. 3	Heine-Borel theorem for 'R' and it's Application's	4=2(L)+2(T)
III. 4	Locally compact T_2-space	3=2(L)+1(T)
III. 5	Lebesgue covering Lemma,	4=2(L)+2(T)
IV	**Completely Normal Spaces**	**Total Lec= 11**
IV. 1	Basic property of Completely Normal Spaces	5=3(L)+2(T)
IV. 2	Completely Normal Spaces theorem's	2=1(L)
IV. 3	Completely Normal Spaces Application's	4=2(L)+2(T)
V	**Product space**	**Total Lec= 7**
V. 1	Weak Topologies, Product space with Hausdorff-space	5=3(L)+2(T)
V. 2	Tychnoff theorem and its application's	2=2(L)
VI	**Urysohn's Lemma**	**Total Lec=16**
VI.1	Some basic property of Urysohn's Lemma	3=2(L)+1(T)
VI.2	Urysohn's Application's	3=2(L)+1(T)
VI.3	Urysohn's Embedding Theorem	2=2(L)
VI.4	Theorem on countable space	2=(L)+1(T)
VI.5	Tietze extension Theorm	3=2 (L)+1(T)
VI.6	Tietze numerical problem and its Example	3=2(L)+1(T)

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Each Teaching shall consist of 60 minutes time duration.

Reference Books:

(1). Introduction to Topology and Modern Analysis by G.F.Simmons

(2). Topology by J.N.Sharma

(3). General Topology by Munkers

Complex Analysis		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Funtion of a complex variable**	**Total Lec= 17**
I. 1	Concept of limit, continuity and differentiability of complex functions	2=1(L)+1 (T)
I. 2	Analytic functions	3=2(L)+1(T)
I. 3	Cauchy-Riemann equations	5=3(L)+2(T)
I. 4	Harmonic functions	3=2(L)+1(T)
I. 5	Orthogonal system	4=2(L)+2(T)
II	**Elementary function**	**Total Lec= 20**
II. 1	Mapping by elementary functions	3=2(L)+1(T)
II. 2	Linear and bilinear transformations	3=2(L)+1(T)
II. 3	Fixed points	5=3(L)+2 (T)
II. 4	Cross ration	2=2(L)
II. 5	Inverse points	2=2(L)
II. 6	Critical points	2=2(L)
II. 7	Conformal transformations	3=2(L)+1(T)
III	**Complex integration**	**Total Lec=19**
III. 1	Line integral	2=2(L)
III.2	Cauchy fundamental theorem	6=3(L)+3(T)
III. 3	Cauchy integral formula	4=2(L)+2(T)
III. 4	Morera's theorem	2=1(L)+1(T)
III.5	Liouville theorem	3=2(L)+1(T)
III. 6	Maximum modulus theorem	2=1(L)+1(T)
IV	**Singularities**	**Total Lec= 11**
IV. 1	Basic definition of singularities	5=3(L)+2(T)
IV. 2	Zeros of an analytic function	2=2(L)
IV. 3	Rouches theorem	4=2(L)+2(T)
V	**Fundamental theorem of algebra**	**Total Lec=7**
V. 1	Example on fundamental theorem	5=3(L)+2(T)
V. 2	Analytic continuation	2=2(L)
VI	**The calculus of Residue**	**Total Lec=16**
VI.1	Residue at a pole	3=2(L)+1(T)
VI.2	Computation of residue at a finite pole	3=2(L)+1(T)
VI.3	Cauchy Residue theorem	2=2(L)
VI.4	residue at a pole of order greater than unity	2=2(L)
VI.5	Example on residue theorem	3=2(L)+1(T)
VI.6	Computation of residue at infinity	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books :

(1) Complex Analysis by E. T. Copson

(2) Real and complex analysis by W. Rudin

(3) Introductory Complex Analysis by R.A.Silverman

(4) Fundamental of a Complex Variable by J. N. Sharma

Elective Papers: Thestudent(s) shall select any two paper from the following as elective paper

Numerical Analysis		**L 60 T 30 P 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Solution of algebraic and transcendental Equation**	**Total Lec = 13**
I. 1	Bisection ,	2=1(L)+1(T)
I. 3	Regula-Falsi method,	2=1(L)+1(T)
I.4	Newton –Raphson	3=2(L)+1(T)
II	Secant method	3=2(L)+1(T)
II.1	Rate of convergence	3=2(L)+1(T)
III	**Interpolation**	**Total Lec = 33**
III.1	Finite Differences	2=1(L)+1(T)
	Forward , backward and central differences	2=1(L)+1(T)
III.3	Symbolic relation and separation of symbols	2=1(L)+1(T)
III. 4	factorial notations,	2=1(L)+1(T)
III.5	differences of a polynomial	2=1(L)+1(T)
IV	newton formula for interpolation,	2=1(L)+1(T)
IV. 1	central differences formulae,	3=2(L)+1(T)
IV.2	Bessel formula	3=2(L)+1(T)
IV. 3	Stirling formulae, with unevenly space points,	3=2(L)+1(T)
IV. 4	Lagranges formula	3=2(L)+1(T)
IV.5	Hermite formula	3=2(L)+1(T)
IV.6	Cubic splines	3=2(L)+1(T)
IV. 7	Inverse interpolation	3=2(L)+1(T)
V	**Numerical differentiation**	**Total Lec =5**
V. 1	Maximum and minimum value of tabulated functions,	5=3(L)+2(T)
V. 2	**Numerical integration**	**Total Lec = 15**
V.3	Trapezoidal rules,	3=2(L)+1(T)
V.4	Simpson's 1/3,3/8 rules,	3=2(L)+1(T)
V.5	Weddle's rules	3=2(L)+1(T)
V.6	Newton cotes, Integration formulae,	3=2(L)+1(T)
V.7	Legendre formulae	3=2(L)+1(T)
VI	**Numerical solution of ordinary differential equations**	**Total Lec = 24**
VI.1	Solution by Taylor series	2=1(L)+1(T)
VI.2	Picard's methods	3=2(L)+1(T)
VI.3	Euler's methods,	3=2(L)+1(T)
VI.4	Runge method,	3=2(L)+1(T)
VI.5	Runge-Kutta forth order method,	3=2(L)+1(T)
VI.6	Predictor corrector method, Millne's Methods	3=3(L)
VI.7	Finite difference method,	3=3(L)
VI.8	Simultaneous and higher order equations	3=3(L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

References:

(1). Numerical Analysis: S.S.Sastry

(2). Numerical Method: Jain, Iyenger Jain

Classical Mechanics		L T P 60 30 00
Unit No.	Unit Name	No. of Teachings days 90
I	**Lagrangian dynamics**	**Total Lec= 20**
I. 1	Constraints and Generalized coordinates, degree of freedom,	5= 3(l) +2(T)
I. 3	generalized velocity, Kinetic energy,	5= 3(L)+2(T)
I. 4	Generalised forces	3=2(L)+1(T)
I. 5	lagrangian equations, lagrangian function	5=3(L)+2(T)
I.6	Generalized momentum	2= 1(L)+1(T)
II	Euler's equations,	**Total Lec= 30**
II. 1	Euler's dynamical equations	6=4(L)+2T)
II. 2	Kinetic energy of a rigid body about a fixed point	6=4(L)+2(T)
II. 3	Eulerian angles	4=3(L)+1(T)
II. 4	geometrical relations	4=3(L)+1(T)
II. 5	Instantaneous axis of rotation	4=3(L)+1(T)
II. 6	deduction of Euler's equation from Lagrangian equation	6=4(L)+2(T)
III	Hamiltonian formulation	**Total Lec=26**
III. 1	Hamilton's principal, principal of least action, Fermat's Principle	10=6(L)+4(T)
III. 2	Deduction of lagrange's equation from Hamilton's principal	4= 3(L)+1(T)
III. 3	Hamiltonian –Jacobi theory	6= 4(L)+2(T)
III.$	Routh's procedure	3= 2(L)+1(T)
III.4	Poisson Bracket	3= 2(L)+1(T)
IV	**Technique of calculus of variation**	**Total Lec.=14**
IV.1	Variation of a function	4= 3(L)+1(T)
IV.2	Euler- Lagrange equation	4= 3(L)+1(T)
IV.3	Brachistochrone problem	3=2(L)+1(T)
IV.4	Necessary and sufficient condition for extremum	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

References:

1. Introduction to Classical mechanics, With problems and Solution: David J. Morin
2. Classical Mechanics: Herbert Goldstein
3. Classical Mechanics: Tom W B Kibble , Frank H Berkshire

Differential Geometry		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Definition of space curve, arc length, tangent, normal, binormal**	**Total Lec= 17**
I. 1	The principal normal, Binormal, Helices.	2=1(L)+1(T)
I. 2	Equation of osculating plane	3=2(L)+1(T)
I. 3	Numerical based on osculating plane	5=3(L)+2(T)
I. 4	Serret-Frenet formula	3=2(L)+1(T)
I. 5	Necessary and sufficient condition for curve to be a plane	4=2(L)+2(T)
II	**Fundamental existence theorem for space curves, Helices, evolutes and involutes**	**Total Lec= 20**
II. 1	Curvature and torsion of the involute of given curve	2=1(L)+1 (T)
II. 2	Find Involutes of a circular helix are plane curve	2=2(L)
II. 3	Equation of evolutes of a curve	5=3(L)+2 (T)
II. 4	Locus of the centre of curvature is on evolute	3=2(L)+1 (T)
II. 5	Curvature and torsion of an evolute	2=1(L)+1 (T)
II. 6	Example based on torsion	3=2(L)+1 (T)
II. 7	Example based on involute and evolutes of circular helix	3=2(L)+1 (T)
III	**Interpolation with unevenly space points**	**Total Lec= 19**
III. 1	Lagranges interpolation formulae	2=2(L)
III.2	Example Based on Lagranges formula	6=3(L)+3 (T)
III. 3	Harmit's formulae	4=2(L) +2(T)
III. 4	Example Based on Hermite formula	2=2(L)
III.5	Interpolation with cubic splines	3=2(L)+1 (T)
III. 6	Inverse interpolation	2=2(L)
IV	**A brief account of Bezier curve**	**Total Lec=11**
IV. 1	Definition of surface, tangent plane, surfaces of revolution	5=3(L)+2 (T)
IV. 2	Conoid and Helicoids	2=2(L)
IV. 3	Envelopes and developable surfaces	4=2(L) +2(T)
V	**Matrix and direction coefficients**	**Total Lec=7**
V.1	Second fundamental form	5=3(L)+2 (T)
V.2	Meusnier's theorem	2=2(L)
VI	**Euler's theorem and Dupin's indicatrix**	**Total Lec=16**
VI.1	Gaussian curvature	3=2(L) +1(T)
VI.2	Normal curvature	3=2(L) +1(T)
VI.3	Geodesic curvature	3=2(L)+1 (T)
VI.4	Liouville's formulae	2=2(L)
VI.5	Differential equation of a geodesic	2=2(L)
VI.6	Fundamental theorem on surfaces.	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books:

(1) Differential geometry by D.J.Struik
(2) Differential geometry by Nirmala Prakash
(3) An Introduction to Differential geometry by T.J.Willmore

Discrete Mathematics		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Lattice**	**Total Lec=25**
I. 1	Partially ordered set, Components,	5= 4(L) +1(T)
I. 2	Lattices,	5= 4(L) +1(T)
I. 3	Complete Lattice, Distributive Lattice,	5= 4(L) +1(T)
I. 4	Complimented lattice	5= 4(L) +1(T)
I. 5	Modular Lattice	5= 3(L) +2(T)
II	**Boolean algebra**	**Total Lec=30**
II. 1	Boolean algebra	5= 3(L) +2(T)
II. 2	Boolean functions	5= 3(L) +2(T)
II. 3	Minimization of Boolean Functions,	4= 3(L) +1(T)
II. 4	Karnaugh Map	3= 2(L) +1(T)
II. 5	Switching circuits and Logic circuits	5= 3(L) +2(T)
II. 6	Simplification of circuits	3= 2(L) +1(T)
II. 7	Logic circuits	5= 3(L) +2(T)
III	**Graph theory**	**Total Lec=23**
III. 1	Planar Graphs,	3=2(L) +1(T)
III. 2	Directed Graphs,	3=2(L) +1(T)
III. 3	Walk, Paths,Circuits	5=3(L) +2(T)
III. 4	Eulers graphs	3=2(L) +1(T)
III. 5	Hamilton graphs	3=2(L) +1(T)
III. 6	Trees	3=2(L) +1(T)
III. 7	Spanning trees	3=2(L) +1(T)
IV	**Counting**	**Total Lec=12**
IV. 1	Permutation	3=2(L)+1(T)
IV. 2	Combinations	3=2(L)+1(T)
IV. 3	Pigeonhole principle	2=1(L)+1(T)
IV. 4	Inclusion and Exclusion principle	2=1(L)+1(T)
IV. 5	Derangements	2=1(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

References

(1) Discrete Mathematical Structure with application of Computer Science by J.P. Trembley
(2) Discrete Mathematics by K.A. Rosen
(3) Discrete Mathematical Structures of Computer Science by Kolman& Robert C Bust.

Operation Research		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Definitions & scope of operation research**	**Total Lec=17**
I. 1	Nature and definition of OR	2=2(L)
I. 2	Objective of OR	3=2(L)+1 (T)
I. 3	Scientific method in OR	5=3(L)+2 (T)
I. 4	Characteristic of OR	3=2(L)+1 (T)
I. 5	Modeling in or with some illustravive example..	4=2(L) +2(T)
II	**Different types of models & their construction,linear programming**	**Total Lec=20**
II. 1	Convex set, graphical method	3=2(L)+1 (T)
II. 2	Simplex method	3=2(L)+1 (T)
II. 3	Dual simplex method	5=3(L)+2 (T)
II. 4	Artificial variable techniques	3=2(L)+1 (T)
II. 5	Duality in linear programming problem	2=1(L)+1 (T)
II. 6	Sensitivity analysis,	2=1(L)+1 (T)
II. 7	Example based on duality linear programming	3=2(L)+1 (T)
III	**Integral programming**	**Total Lec=19**
III. 1	Cutting plane, branch & bound techniques for all integers and mixed programming	2=1(L)+1(T)
III.2	Algorithm for 0 to 1	6=3(L)+3 (T)
III. 3	Traveling salesmen	4=2(L)+2 (T)
III. 4	Cargo loading problem	2=2(L)
III.5	Solution of travelling salesman problem	3=2(L)+1(T)
III. 6	Illustrative example on travelling problem.	2=2(L)
IV	**Transportation problem**	**Total Lec= 11**
IV. 1	Transportation with & without transshipment	5=3(L)+2(T)
IV. 2	Allocation & assignment problems	2=2(L)
IV. 3	Some example on transportation problem	4=2(L)+2(T)
V	**Sequencing and scheduling**	**Total Lec=7**
V.1	Processing of jobs through machines	5=3(L)+2(T)
V.2	Example based on sequencing problem	2=2(L)
VI	**CPM and PERT game theory**	**Total Lec=16**
VI.1	Pure & mixed strategies	3=2(L)+1(T)
VI.2	Solution by graphical method	3=2(L)+1(T)
VI.3	Solution by linear programming.	2=2(L)
VI.4	Example on graphical method	2=2(L)
VI.5	Example on mixed strategies problem	3=2(L)+1(T)
VI.6	Example on CPM and PERT	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books

(1) Operation Research by S .D.Sharma
(2) Operation Research by J.K.Sharma
(3) Operation Research:an introduction by H.A.Taha

Object Oriented Programming with C++		L 60 T 15 P 15
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Characteristics of object oriented languages**	**Total Lec = 11**
I. 1	Feature of C++, Problem With Procedural Language,	3=1(L)+1(T)+1(P)
I. 2	object, class, inheritance and reliability	2=1(L)+1(T)
I.3	Polymorphism, overloading,	3=3(L)+1(T)+1(P)
I.4	creating new data type,	3=1(L)+1(T)+1(P)
I.5	output using cout,	**Total Lec = 8**
I.6	input using cin,	2=1(L)+1(T)
I.7	Manipulators,	2=2(L)
I.8	Types Conversion	2=1(L)+1(P)
I. 9	enumerated data type,	2=1(L)+1(T)
II	**Functions**	**Total Lec = 15**
II. 1	Simple function,	3=2(L)+1(P)
II.2	Function declaration,	3=1(L)+1(T)+1(P)
II. 3	Overloading function,	3=1(L)+1(T)+1(P)
II. 4	Inline function	3=1(L)+1(T)+1(P)
II.5	different type of variable and storage class,	3=1(L)+1(T)+1(P)
III	**Object and Classes**	**Total Lec = 26**
III. 1	Specifying the class	3=3(L)
III.2	C++ object as function	3=2(L)+1(T)
III.3	argument overload constructors	5=3(L)+1(T)+1(P)
III.4	member function define outside the class	3=1(L)+1(T)+1(P)
III.5	static class data	3=3(L)
III.6	Different b/w structure	3=3(L)
III.7	structure and class	3=3(L)
III.8	static class data,	3=2(L)+1(T)
IV	**Operators**	**Total Lec = 15**
IV.1	Overloading	3=3(L)
VI.1	Unary operators	3=3(L)
VI.2	Overloading binary operators	3=2(L)+1(P)
VI.3	Data conversion,	3=2(L)+1(P)
VI.4	Pitfalls of operator overloading	3=2(L)+1(T)
V	**Inheritance**	**Total Lec = 15**
V.1	Derive class and base class,	3=3(L)
V.2	Constructor	3=3(L)
V.3	Overloading member function	3=2(L)+1(P)
V.4	Types of inheritance	3=2(L)+1(P)
V.5	Public and private inheritance,	3=2(L)+1(P)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

ReferencesBooks:

(1) Object Oriented Programming & C++ by Robert Lafore
(2) Let Us C++ by YaswantKanitkar
(3) C++ Programming by E. Balagurushamy

M.A

M.Sc (Mathematics)Third Semester Paper
Syllabus and Teaching Plan

Number Theory		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Basic concepts**	**Total Lec= 16**
I. 1	Prime numbers , The fundamental theorem of Arithmetic	3=2(L)+1(T)
I. 2	The series of reciprocals of primes	4=3(L)+1(T)
I. 3	The Euclidean Algorithm , Fermat ND Mersenne numbers	3=2(L)+1(T)
I. 4	Farey series ,farey dissection of the continuum	4=3(L)+1(T)
I. 5	Irrational numbers Irrationality of m^{th} root of N , e and π	2=1(L)+1(T)
II	**Arithmetical Functions**	**Total Lec=20**
II. 1	The Mobius function	2=1(L)+1(T)
II. 2	Euler function & sigma function	4=3(L)+1(T)
II. 3	Dirichlet product of Arithmetical functions, Multiplicative functions	3=2(L)+1(T)
II. 4	Averages of Arithmetical functions	2=1(L)+1(T)
II. 5	Some elementary asymptotic formulas	5=3(L)+2(T)
II. 6	The average orders of $d(n),\varphi(n),\mu(n)$	2=1(L)+1(T)
II. 7	An application to the distribution of lattice points visible from the origin	2=1(L)+1(T)
III	**Approximation Irrational numbers**	**Total Lec=16**
III. 1	Hurwitz's theorem	4=3(L)+1(T)
III.2	Representation of a number by two or four squares	2=1(L)+1(T)
III. 3	Definition g(k) and G(k), proof of $g(4)<50$	2=1(L)+1(T)
III. 4	Perfect numbers	2=1(L)+1(T)
III.5	The series of Fibonacci	2=1(L)+1(T)
III. 6	The series of Lucas	2=1(L)+1(T)
IV	**Continued fraction**	**Total Lec=10**
IV. 1	Finite continued fractions	4=3(L)+1(T)
IV. 2	Convergent of a continued fraction	3=2(L)+1(T)
IV. 3	Topic based theorem and problems	3=1(L)+2(T)
V	**Simple continued fractions**	**Total Lec=8**
V.1	Continued fractions with positive quotients	5=3(L)+1(T)
V.2	Topic based theorem and problrms	3=2(L)+1(T)
VI	**The representation of an irreducible rational fraction by a simple continued fraction**	**Total Lec= 20**
VI.1	The continued fraction algorithm	4=3(L)+1(T)
VI.2	Euclid's algorithm	2=2(L)
VI.3	The difference between the fractio and its convergents	5=3(L)+2(T)
VI.4	Infinite simple continued fraction	3=3(L)
VI.5	Equivalent numbers and periodic continued fractions	4=2(L)+2(T)
VI.6	Some special quadratic surds	2=2(L)
15 Week Working Days. = 90c Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1) An introduction to the theory of number : Hugh Lowell Montgomery and Ivan M. Niven
(2) An introduction to the theory of number : G.H. Hardy

Mathematical Method		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Fourier Integral theorem**	**Total Lec =16**
I. 1	Basic properties of fourier integral	3=2(L)+1(T)
I. 2	Infinite fourier transform	4=2(L)+2(T)
I. 3	Infinite Fourier sine and cosine transform	3=2(L)+1(T)
I. 4	Finite fourier transform	4=3(L)+1(T)
I. 5	Finite fourier sine and cosine transform	2=1(L)+1(T)
II	**Laplace Transform**	**Total Lec=20**
II. 1	Piece-wise or sectional continuity	2=2(L)
II. 2	Function of exponential order	4=3(L)+1(T)
II. 3	Laplace transform	3=2(L)+1(T)
II. 4	Notation	2=2(L)
II. 5	Some standard results	5=3(L)+2(T)
II. 6	Periodic functions	2=2(L)
II. 7	Problems	2=2(L)
III	**Inverse Laplace Transform**	**Total Lec=16**
III. 1	Definition and threoms	4=3(L)+1(T)
III.2	Null function	2=1(L)+1(T)
III. 3	Uniqueness of inverse Laplace transform	2=1(L)+1(T)
III. 4	Partial Fractions	2=1(L)+1(T)
III.5	Heaviside's expansion formula	2=1(L)+1(T)
III. 6	The complex inversion formula	2=1(L)+1(T)
IV	**Application to Differential Equations**	**Total Lec=10**
IV. 1	Differential Equation and Notation	4=3(L)+1(T)
IV. 2	Worked examples	3=2(L)+1(T)
IV. 3	Solution of simultaneous ordinary Differential Equation	3=1(L)+2(T)
V	**Application to Integral Equations**	**Total Lec=8**
V.1	Topic based theorems and formulae	5=3(L)+1(T)
V.2	Exercise	3=2(L)+1(T)
VI	**Application of Fourier Transforms to Boundary Value Problems**	**Total Lec= 20**
VI.1	Application of infinite fourier transform	4=3(L)+1(T)
VI.2	Theorems and formulae	2=1(L)+1(T)
VI.3	Topic based exercise	5=3(L)+2(T)
VI.4	Application of finite fourier transform	3=2(L)+1(T)
VI.5	Theorems	4=2(L)+2(T)
VI.6	Formulae and examples	2=1(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1) Fourier series and boundary value problems by R.V. Churchill.
(2) Fourier transforms by I.N. Sneddon.

Elective Papers: Thestudent(s) shall select any two paper from the following as elective paper

Fluid Dynamics		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Kinematics of the flow field**	**Total Lec.= 17**
I. 1	Basic properties of fluid	2=1(L)+1(T)
I. 2	Lagrangian and Eulerian description	3=2(L)+1(T)
I. 3	Equation of continuity, cylindrical and spherical symmetry	5=3(L)+2(T)
I. 4	Velocity Potential, Stream lines	3=2(L)+1(T)
I. 5	Rotational and Irrotaional flow, Vorticity vector	4=3(L)+1(T)
II	**Conservation of momentum and energy**	**Total Lec. =20**
	Boundary Surfaces	3=2(L)+1(T)
II. 1	Eulers dynamical equation of motion	3=2(L)+1(T)
II. 2	Bernoulli's theorem and its applications	5=3(L)+2(T)
II. 3	Flow and Circulation	3=2(L)+1(T)
II. 4	Kelvin's Circulation theorem	1=1(L)
II. 5	Stokes theorem	2=1(L)+1(T)
II. 6	Multiply connected spaces, Kelvin's minimum energy theorem	3=2(L)+1(T)
III	**Motion in two dimensions**	**Total Lec.= 19**
III. 1	Stream function,	2=1(L)+1(T)
III. 2	Complex potential , Complex velocity	6=4(L)+2(T)
III. 3	Source, Sink	4=3(L)+1(T)
III. 4	Doublet	2=1(L)+1(T)
III. 5	Milnes Thomson circle theorem and its applications	3=2(L)+1(T)
III. 6	Images	2=1(L)+1(T)
IV	**General motion of cylinder in two dimensions**	**Total Lec.=11**
IV. 1	Circular cylinder, Two co-axial cylinders	5=4(L)+1(T)
IV. 2	Blasius Theorem	2=1(L)+1(T)
IV. 3	Elliptic cylinder, Kinetic energy of a rotating elliptic cylnder	4=3(L)+1(T)
V	**Motion in three dimensions**	**Total Lec.=7**
V.1	Source ,Sinks, doublet	5=4(L)+1(T)
V.2	Motion of a sphere	2=1(L)+1(T)
VI	**Viscous Fluid**	**Total Lec.=16**
VI.1	Stress tensor	3=2(L)+1(T)
VI.2	Normal and Shearing Strain	3=2(L)+1(T)
VI.3	Stoke's Relation	2=1(L)+1(T)
VI.4	Navier-Stoke's equation of motion	2=1(L)+1(T)
VI.5	Diffusion of vorticity, dissipation of energy	3=2(L)+1(T)
VI.6	Laminar flow between parallel plates, Plane Couette flow, Hagen-Poiseuille flow through a circular pipe	3=3(L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books:

(1) Introduction to fluid dynamics by S.W. Yuan
(2) Text Book of fluid dynamics: F. Chorlton
(3) Fluid dynamics: M.D. Raisinghania.

Mathematical Statistics		L T P 60 30 00
Unit No.	**Unit Name**	**Number of teachings days 90**
I	**Probability**	**Total Lec= 16**
I. 1	Introduction of terminology based on Probability	4=1(L)+1(T)
I. 2	Definitions of Probability	3=1(L)+1(T)
I. 3	Theorem on Probability	3=1(L)+1(T)
I. 4	Conditional Probability	3=1(L)+1(T)
I. 5	Bayes theorem	3=1(L)+1(T)
II	**Random Variables & Mathematical Expectation**	**Total Lec=15**
II. 1	Discrete Random Variable	2=1(L)+1(T)
II. 2	Continuous Random Variable	2=1(L)+1(T)
II. 3	Theorem of Expectation	2=1(L)+1(T)
II. 4	Expectation of a linear combination of random variable	2=1(L)+1(T)
II. 5	Characteristic function	2=1(L)+1(T)
II. 6	Moment	2=1(L)+1(T)
II. 7	Moment Generating function	2=1(L)+1(T)
II. 8	Cumulant Generating Function	1=1(L)
III	**Correlation and Regression**	**Total Lec= 12**
III. 1	Karl Pearson Correlation Coefficient	2=1(L)+1(T)
III. 2	Spearman Rank Correlation	2=1(L)+1(T)
III. 3	Lines of regression, Regression coefficient	3=2(L)+1(T)
III. 4	Multiple &Partial Correlation	2=1(L)+1(T)
III. 5	Plane of regression	3=2(L)+1(T)
IV	**Probability distribution**	**Total Lec= 23**
IV. 1	Binomial Distribution	5=4(L)+1(T)
IV. 2	Geometric distribution	2=2(L)
IV. 3	Hyper Geometric distribution	3=2(L)+1(T)
IV. 4	Normal distribution	3=2(L)+1(T)
IV. 5	Beta I distribution	3=2(L)+1(T)
IV. 6	Beta II distribution	3=2(L)+1(T)
IV. 7	Gamma distribution	4=3(L)+1(T)
V	**Sampling theory**	**Total Lec=12**
V.1	Purposive sampling	4=3(L)+1(T)
V.2	Random sampling	2=2(L)
V.3	Systematic sampling	3=2(L)+1(T)
V.4	Stratified sampling	3=2(L)+1(T)
VI	**Testing of Hypothesis**	**Total Lec=12**
VI.1	z- test	3=2(L)+1(T)
VI.2	t- test	3=2(L)+1(T)
VI.3	F- test	3=2(L)+1(T)
VI.4	Chi-Square test	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

References Books:

(1) Mathematical Statistics (vol – I) J.F. Kenny & F.S. Keeping.

(2) Mathematical Statistics J.N. Kapoor & H.C. Saxena.

(3) Introduction to the theory of statistics A.M. Mood & F.A. Graybill.

Advance Operation Research — L T P: 60 30 00

Unit No.	Unit Name	No. of Teachings days 90
I	**Non linear programming:**	**Total Lec=17**
I. 1	Quadratic programming: Convex sets & convex function, Kun-Tucker Conditions	2=2(L)
I. 2	Kun-Tucker Conditions for non-negative constraints, Kun-Tucker Conditions for non-negative constraints for quadratic programming problem.	3=2(L)+1(T)
I. 3	Wolfe's Method	5=3(L)+2(T)
I. 4	Beale's method.	3=2(L)+1(T)
I. 5	Simplex method for quadratic programming.	3=2(L)+1(T)
II	**Separable programming:**	**Total Lec=20**
II. 1	Separable functions,	3=2(L)+1(T)
II. 2	Reducible to separable forms.	3=2(L)+1(T)
II. 3	Separable programming problem, convex programming.	5=3(L)+2(T)
II. 4	Piece-wise linear approximation of non-linear function	3=2(L)+1(T)
II. 5	Reduction of separable programming problem to L.P.P.	2=2(L)
II. 6	Separable programming algorithm	2=2(L)
II. 7	Example based on separable algorithm.	3=2(L)+1(T)
III	**Geometric Programming :**	**Total Lec=19**
III. 1	Formulation of geometric programming problem (unconstrained type).	2=1(L)+1(T)
III. 2	To derive necessary condition for optimality.	6=3(L)+3(T)
III. 3	To find the expression minimum F(x).	4=2(L)+2 (T)
III. 4	Formulation of geometric programming problem : with equality constraints.	2=1(L)+1(T)
III. 5	To obtain normality and orthogonality conditions	3=2(L)+1(T)
III. 6	Problem with inequality constraint.	2=1(L)+1(T)
IV	**Dynamic Programming:**	**Total Lec=11**
IV. 1	Decision tree and Bellmans principal optimality,	5=3(L)+2(T)
IV. 2	State the principal of optimality in dynamic programming., it's basic features	2=1(L)+1 (T)
IV. 3	Optimal subdivision problem.	4=2(L)+2(T)
V	**Dynamic Programming with model:**	**Total Lec= 7**
V. 1	Model I: minimum path problem.	2=2(L)
V. 2	Model II: single additive constraints, multiplicatively separable return	2=2(L)
V. 3	Model III: single additive constraints, additively separable return, Model: IV, Model:V	3=2(L)+1(T)
VI	**Queueing Theory (Waiting Lines Models)**	**Total Lec=16**
VI.1	Transient and Steady States, Traffic Intensity, The poisson process (Pure birth process).	3=2(L)+1(T)
VI.2	Properties of poisson process of aarivals, distribution of departure (pure death process)	3=2(L)+1(T)
VI.3	Erlang service time distribution (E_k)., Classification of queueing models.	2=2(L)
VI.4	Model I: (M/M/1): (∞/FCFS) Birth and Death model.	2=2(L)

VI.5	Model II: General Erlang Queueing model (Birth death process) (M/M/1): (∞/ SIRO), Model III: (M/M/1) : (N/ FCFS)., MODEL IV(A) .(M/M/S): (∞/FCFS).	3=2(L) +1(T)
VI.6	Some illustrative example on given models.	3=2(L) +1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

References Books:

(1) Fundamental of Queueing by D.Gross&C.M.Harris

(2) Operation Research: An introduction by H.A. Taha

Graph Theory		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	Introduction to graph,	**Total Lec = 24**
I. 1	Simple graph	3= 2(L)+1(T)
I. 2	Degree of a graph,	3= 2(L)+1(T)
I. 3	Regular graph	3= 2(L)+1(T)
I. 4	Complete graph,	3= 2(L)+1(T)
I. 5	Bipartite Graph,	3= 2(L)+1(T)
I. 6	Digraph,	3= 2(L)+1(T)
I. 7	Sub graph	3= 2(L)+1(T)
I. 8	Complement of a graph	3= 2(L)+1(T)
II	**Traversing a graph**	**Total Lec = 21**
II. 1	Walks	3=2(L)+1(T)
II. 2	Path	3=2(L)+1(T)
II. 3	Circuits,	3=2(L)+1(T)
II. 4	Connectedness of a graph	3=2(L)+1(T)
II. 5	Planner graph	3=2(L)+1(T)
II. 6	Binary relation	3=2(L)+1(T)
II. 7	Matrix representation of graphs adjacency, incidence matrices	3=2(L)+1(T)
III	**Euler and Hamiltonian graphs**	**Total Lec=30**
III. 1	Euler's formula	5=3(L)+2(T)
IV. 2	Eulerian graphs	5=3(L)+2(T)
IV. 3	Hamiltonian graphs and circuits,	5=3(L)+2(T)
IV. 4	Existence theorem for Eulerian and Hamiltonian graph,	3=2(L)+1(T)
IV. 5	Vertex removal,	3=2(L)+1(T)
IV. 6	Cut vertices	3=2(L)+1(T)
IV. 7	Separable graphs ,	3=2(L)+1(T)
	Isomorphism,	3=3(L)
IV	**Tree graph**	**Total Lec=15**
IV. 1	Tree	3=2(L)+1(T)
IV. 2	Spanning tree	3=2(L)+1(T)
IV. 3	Breadth-first search	3=2(L)+1(T)
IV. 4	Depth first search	3=2(L)+1(T)
IV. 5	Cut sets and tie sets.	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1) Applied Graph Theory by C.W. Marshall

(1) Graph theory with applications by J.K. Bondy& U.S.R. Murty

Special Function		L T P 60 30 00
Unit No.	Unit Name	No. of Teachings days 90
I	**Gamma function and beta function**	**Total Lec= 17**
I. 1	Eulerian definition, weirtrass definition	2=1(L)+1(T)
I. 2	Euler product, factorial function	3=2(L)+1(T)
I. 3	Equivalence of weirtrass and euler definition	5=3(L)+2(T)
I. 4	Legendre's duplication formula,Factorial function	3=2(L)+1(T)
I. 5	Some illustravive example..	4=2(L)+2(T)
II	**The order o and Asymptotic expansion hyper geometric function 2F1**	**Total Lec= 20**
II. 1	Integral representation of F(a,b;c,z)	3=2(L)+1 (T)
II. 2	Hypergeometrical differential equation	3=2(L)+1 (T)
II. 3	Transformations of F(a,b;c,z)., simple transformation	5=3(L)+2 (T)
II. 4	Quadratic transformation	2=1(L)+1(T)
II. 5	Relation of contiguity	2=1(L)
II. 6	Example based on contiguity	2=1(L)
II. 7	Example based on hypergeometric function	3=2(L)+1 (T)
III	**Generalized hyper geometric function**	**Total Lec= 19**
III. 1	Differential equation satisfied by p^f_q	2=2(L)
III.2	Saalschutz theorem	6=3(L)+3 (T)
III. 3	Whipples theorem	4=2(L)+2(T)
III. 4	Dixon's theorem	2=2(L)
III. 5	Integrals involving generalized hypergeometric function	3=2(L)+1(T)
III. 6	Illustrative example.	2=2(L)
IV	**Bessel functions**	**Total Lec= 11**
IV. 1	Generating function $J_n^{(x)}$	5=3(L)+2(T)
IV. 2	Alternative form of generating function	2=2(L)
IV. 3	Bessel's differential equation and its example	4=2(L)+2(T)
V	**Legendre polynomial**	**Total Lec=7**
V. 1	Recurrence relations	5=3(L)+2(T)
V. 2	Various form of $P_n^{(x)}$	2=2(L)
VI	**Hermitepolynomials,Laguerre polynomial**	**Total Lec=16**
VI.1	Solution of hermite differential equation, laguree diff. Equa.	3=2(L)+1(T)
VI.2	Generating functions	3=2(L)+1 (T)
VI.3	Rodrigues formiulae	2=1(L)+1(T)
VI.4	Other form of hermite , laguree polynomial	2=2(L)
VI.5	Jacobi polynomials	3=2(L)+1(T)
VI.6	Generating function of Jacobi polynomial	3=2(L)+1 (T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1). Special Functions by E.D. Rainville

(2). Theory of Function of a complex variable by E.T.Copson

Java Programming		L T P 60 30 00
Unit No.		No. of Teachings days 90
I	**Introduction**	**Total Lec= 25**
I. 1	Review of Object oriented concepts, History of Java, Java buzzwords	5=3(L)+1(T)
I. 2	JVM architecture	3=2(L)+1(T)
I. 3	Data types, Variables, Scope and life time of variables,	5=3(L) +2(T)
I. 4	arrays, operators, control statements, type conversion and casting	3=2(L) +1(T)
I. 5	simple java program, constructors, methods, Static block, Static Data,	4=2(L)+ 2(T)
I.6	Static Method String and String Buffer Classes, Using Java API Document	5=3(L) +2(T)
II	**Inheritance and polymorphism**	**Total Lec= 20**
II. 1	Basic concepts, Types of inheritance, Member access rules	3=2(L)+1 (T)
II. 2	Usage of this and Super key word, Method Overloading, Method overriding,	3=2(L)+1 (T)
II. 3	Abstract classes, Dynamic method dispatch, Usage of final keyword.	5=3(L)+2(T)
II. 4	Packages and interfaces: Defining package, Access protection, importing packages,	2=1(L)+1(T)
II. 5	Defining and Implementing interfaces, and Extending interfaces.	2=1(L)+1(T)
II. 6	I / O Streams: Concepts of streams, Stream classes- Byte and Character stream	2=2(L)
II. 7	Reading console Input and Writing Console output, File Handling	3=2(L)+1 (T)
III	**Exception handling**	**Total Lec= 19**
III. 1	Exception types, Usage of Try, Catch, Throw, Throws and Finally keywords,	2=2(L)
III. 2	Built-in Exceptions, Creating own Exception classes	6=3(L) +3(T)
III. 3	MULTI THREADING, Concepts of Thread,	4=2(L)+2 (T)
III. 4	Thread life cycle	2=2(L)
III. 5	creating threads using Thread class and Run able interface,	3=2(L)+1(T)
III. 6	Synchronization, Thread priorities, Inter Thread communication.	2=2(L)
IV	**Awt controls**	**Total Lec= 08**
IV. 1	The AWT class hierarchy	4=2(L)+2 (T)
IV. 2	user interface components-	2=2(L)
IV. 3	Labels, Button, Text Components, Check Box, Check Box Group	2=1(L)+1(T)
V	**Choice, List Box, Panels – Scroll Pane, Menu, Scroll Bar.**	**Total Lec= 18**
V.1	Working with Frame class, Colour, Fonts and layout managers.	2=1(L)+1(T)
V.2	EVENT HANDLING: Events, Event sources, Event Listeners, Event Delegation Model (EDM),	2=2(L)
V.3	Handling Mouse and Keyboard Events, Adapter classes, Inner classes.	2=1(L)+1(T)
V.4	Introduction to Swings, Hierarchy of swing components.	2=1(L)+1(T)
V.5	Containers, Top level containers -	2=2(L)
V.6	JFrame, JWindow, JDialog, JPanel, JButton,	2=1(L)
V.7	JToggleButton, JCheckBox, JRadioButton,	2=1(L)+1 (T)
V.8	JLabel,JTextField, JTextArea, JList, JComboBox, JScrollPane	2=1(L)+1 (T)
V.9	APPLETS: Life cycle of an Applet	1=1(L)
V.10	Differences between Applets and Applications, Developing applets, simple applet.	1=1(L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

References Books:

(1). Herbert schildt , The complete reference, Tata Mc graw Hill, New Delhi
(2). T. Budd (2009), An Introduction to Object Oriented Programming, 3rd edition, PearsonEducation, India.
(3). J. Nino, F. A. Hosch (2002), An Introduction to programming and OO design using Java, John Wiley & sons, New Jersey.
(4). Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, India.
(5). Java Programming by E. Balagursamy

M.Sc/M.A.(Mathematics) Fourth Semester Paper

Syllabus and Teaching plan

Functional Analysis		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Banach space**	**Total Lec = 15**
I. 1	Normed linear space	5=3(L)+2(T)
I. 2	Holder inequality, minkowskis inequality, Schwarz inequality	5=3(L)+2(T)
I. 3	Sub Spaces and Quotient spaces	5=3(L)+2(T)
II	**Bounded linear operators**	**Total Lec = 13**
II. 1	open mapping lemma	5=3(L)+2(T)
II. 2	open mapping theorem	3=2(L)+1(T)
II. 3	uniform boundness principle	3=2(L)+1(T)
II. 4	closed graph theorem	2=2(L)
III	**Bounded Linear Functional**	**Total Lec = 20**
III. 1	Hahn banach theorem	5=3(L)+2(T)
III. 2	The natural imbedding of N and N**	5=3(L)+2(T)
III. 3	Projections	5=3(L)+2(T)
III. 4	conjugate space, conjugate of an operator	5=3(L)+2(T)
III. 5	weak and strong convergence,	
IV	**Hilbert space**	**Total Lec=30**
IV. 1	Properties of Hilbert space	6=4(L)+2(T)
IV. 2	Inner product space, conjugate space(H*),	6=4(L)+2(T)
IV. 3	Schwartz inequality, ,	2=2(L)
IV. 4	Orthogonal complement, orthonormal set	4= 3(L)+1(T)
IV. 5	Projection theorem	2=2(L)
IV. 6	Bessel's inequality	3=2(L)+1(T)
IV. 7	Adjoint of an operator, self adjoint operator,	3=2(L)+1(T)
IV. 8	Normal and unitary operator, projections, perpendicular projection	4= 3(L)+1(T)
V	**Finite dimensional spectral theory**	**Total Lec=12**
V. 1	Eigen values	3= 2(L)+1(T)
V. 2	Existence of Eigen values,	3= 2(L)+1(T)
V. 3	Eigen vectors	3= 2(L)+1(T)
V. 4	Spectral Theorem	3= 2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books:

(1). Introduction of Topologies & modern Analysis : G.F Simmons

(2). Functional analysis:WalterRudin

(3). Functional analysis: P.K Jain , O.P Ahuja, Khalil Ahmad

Measure Theory		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Sets**	**Total Lec = 17**
I. 1	Basic Concept of Sets, ,	3=2(L)+1(T)
I. 2	Measure	3=2(L)+1(T)
I. 3	Measurable Sets,	3=2(L)+1(T)
I. 4	Lebesgue Measure of a Set	3=2(L)+1(T)
II	Exterior and Interior measure	5=3(L)+2(T)
II	**Functions**	**Total Lec = 30**
II. 1	Measurable Space	5=3(L)+2(T)
II. 2	Measurable functions,	3=2(L)+1(T)
II. 3	Equivalent function,	3=2(L)+1(T)
II. 4	Simple Function,	2=2(L)
III	**Lebesgue Measurable functions,**	2=2(L)
III. 1	Lebesgue Measurable functions,	5=3(L)+2(T)
III. 2	Characteristic function,	5=3(L)+2(T)
III. 3	Lebesgue integral of a function	5=3(L)+2(T)
IV	**Theorems**	**Total Lec = 27**
IV. 1	First mean value theorem	5=3(L)+2(T)
IV. 2	Conversions of measure	5=3(L)+2(T)
IV. 3	Uniform Convergence	5=3(L)+2(T)
IV. 4	Reisz Theorem	6=4(L)+2(T)
IV. 5	D.F.Egor's Theorem	6=4(L)+2(T)
V	**Extension of a measure**	**Total Lec = 16**
V. 1	Extension of a measure	4=3(L)+1(T)
V. 2	Continuous and absolute continuous function	2=2(L)
V. 3	Indefinite integral and differential function	3=2(L)+1(T)
V. 4	Increasing and decreasing function	3=2(L)+1(T)
V. 5	Function of a bounded variation	4=3(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

1. Measure theory by P. R. Halmos
2. Measure Theory by K. P. Gupta

Elective Papers: The student(s) shall select any two paper from the following as elective paper

Partial Differential Equations		**L T P** **60 30 00**
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Partial Differential Equation of first order**	**Total Lec = 15**
I. 1	Derivation of Partial differential equation	5= 3(L)+2(T)
I. 2	Langrage's Linear Equation,	5= 3(L)+2(T)
I. 3	Langrage's Solution of linear equation ,	5= 3(L)+2(T)
II.	**Linear equation with n independent variable**	**Total Lec = 30**
II. 1	Special Type of equation	10= 7(L)+3(T)
II. 2	General method of Solution,	5= 3(L)+2(T)
II. 3	Charpit's Method,	5= 3(L)+2(T)
II. 4	Jacobi's Method	5= 4(L)+1(T)
II. 5	Cauchy's Problem	5= 4(L)+1(T)
III	**Partial Differential equation with constant coefficient**	**Total Lec = 20**
III. 1	Homogeneous linear with Constant coefficient,	5= 3(L)+2(T)
III. 2	Solution of Partial Differential equation , Short Method, General method	5= 4(L)+1(T)
III. 3	Non-homogeneous equation with constant coefficient,	5= 3(L)+2(T)
III. 4	Equation reducible to Homogeneous linear form	5= 3(L)+2(T)
IV	**Partial Differential Equation of second order**	**Total Lec = 25**
IV.1	Solution of non-linear Partial Differential equation of second order	5= 3(L)+2(T)
IV.2	Classification of linear partial differential equation of second order,	5= 3(L)+2(T)
IV.3	Canonical form and reduction to canonical form	5= 4(L)+1(T)
IV.4	Monge's method,	5= 4(L)+1(T)
IV.5	Homogeneous linear equations with variable coefficients	5= 3(L)+2(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books:

1. Ordinary differential Equation by M. D. Rai Singhni
2. Differential Equation by Sharma and Gupta
3. Element of Partial Differential Equation by I.N. Sneddon

Theory Relativity		L T P 60 30 00
Unit No.	Unit Name	No. of Teachings days 90
I	**Special relativity**	**Total Lec = 14**
I. 1	Lorentz transformation,	2=1(L)+1(T)
I. 3	Relativistics mechanics,4-dimensional formalism	3=2(L)+1(T)
I. 4	Invariance of Maxwell's Electromagnetic Equation	3=2(L)+1(T)
I. 5	Energy momentum tensor,	3=2(L)+1(T)
I. 6	Radiation from an accelarating Charge	3=2(L)+1(T)
II	**Tensor analysis**	**Total Lec = 43**
II.1	Riemann Curvature Tensor	5= 3(L)+2(T)
II.2	Bianchi identities	4= 3(L)+1(T)
II.3	Geodesics	4= 3(L)+1(T)
III	**Einstein Field Equation**	5= 3(L)+2(T)
III.1	Schwarzschild solution	5= 3(L)+2(T)
III.2	Three test of general relativity	5= 3(L)+2(T)
III.3	Black Holes	5= 3(L)+2(T)
III.4	Field equations for empty and non empty space	5= 3(L)+2(T)
III.5	Interior solution of Schwarzschild	5= 3(L)+2(T)
IV	**Cosmology**	**Total Lec = 33**
IV.1	Einstein and De Sitter Universe	3=2(L)+1(T)
IV.2	Robertson -Walker metric	3=2(L)+1(T)
IV.3	Expanding Universe model	3=2(L)+1(T)
IV.4	Nebular red –Shift	3=2(L)+1(T)
IV.5	Field of a charged mass point	3=2(L)+1(T)
IV.6	gravitational field of a radiating state	3=2(L)+1(T)
IV.7	Linearised field equation	3=2(L)+1(T)
IV.8	gravitational waves,	3=2(L)+1(T)
IV.9	Plane and cylindrical wave	3=2(L)+1(T)
IV.10	Solution of $R_{ij}=0$,	3=3(L)
IV.11	Equation of motion, variational principle and conservation laws.	3=3(L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1). Introduction to the theory of Relativity P.G.Bermann
(2). Theory of Relativity by W.Pauli

Bio – Mathematics		L T P 60 30 00
Unit No.	Unit Name	No. of Teachings days 90
I	**Bio -Mathematics**	**Total Lec.=16**
I. 1	Introduction to Bio-Mathematics	3=2(L)+1(T)
I. 2	Population dynamics	4=2(L)+2(T)
I. 3	Two species population model	3=2(L)+1(T)
I. 4	Models for competition	4=3(L)+1(T)
I. 5	Topic based Problems	2=2(L)+1(T)
II	**Optimal exploitation models**	**Total Lec=20**
II. 1	Growth of population with harvesting	2=1(L)+1(T)
II. 2	Age structural models	4=3(L)+1(T)
II. 3	Topic based problems	3=2(L)+1(T)
II. 4	Delay models	2=1(L)+1(T)
II. 5	Topic based problem	5=3(L)+2(T)
II. 6	Optimal exploitation models	2=1(L)+1(T)
II. 7	Problems	2=1(L)+1(T)
III	**Epidemics**	**Total Lec.=16**
III. 1	Deterministic epidemic model..	4=3(L)+1(T)
III. 2	And without removal control of epidemics model in a genetics	2=1(L)+1(T)
III. 3	Basic model for inheritance	2=1(L)+1(T)
III. 4	Model for genetic improvement	2=1(L)+1(T)
III. 5	Genetic inbreeding	2=2(L)
III. 6	Topic based problem	2=2(L)
IV	**Basic equations special cases of one and two compartants**	**Total Lec.=10**
IV. 1	Define special cases	4=3(L)+1(T)
IV. 2	Pharm eco-kinectics	3=2(L)+1(T)
IV. 3	Worked Examples	3=1(L)+2(T)
V	**Haemo dynamics**	**Total Lec= 08**
V.1	Introduction	5=3(L)+1(T)
V.2	Exercise	3=2(L)+1(T)
VI	**Haemo dynamics structure and flow properties of blood**	**Total Lec.=20**
VI.1	Flow properties of blood	4=3(L)+1(T)
VI.2	Blood flow in circulatory system	2=2(L)
VI.3	Effects of mild stenosis	5=3(L)+2(T)
VI.4	Pulsatile flow	3=2(L)+1(T)
VI.5	Introduction to peristaltic motion	4=2(L)+2(T)
VI.6	Lubrication in human joints	2=2(L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

(1). Mathematical models in Biology and Medicine by J.N. Kapoor.
(2). Genetics by S. Stainsfield.

Python		L T P 60 15 15
Unit No.	Unit Name	No. of Teachings days 90
I	**Introduction**	**Total Lec= 17**
I. 1	The Programming Cycle for Python , Python IDE,	2=1(L)+1(T)
I. 2	Interacting with Python Programs , Elements of Python,	3=1(L)+1(T)+1(P)
I. 3	Type Conversion. Basics: Expressions,	5=3(L)+2(T)
I. 4	Assignment Statement, Arithmetic Operators, Operator Precedence,	3=2(L)+1(P)
I. 5	Boolean Expression.	4=2(L)+2(T)
II	**Conditionals**	**Total Lec= 16**
II. 1	Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and else- if statement in Python,	3=2(L)+1(P)
II. 2	Expression Evaluation & Float Representation.	3=1(L)+1(T)+1(P)
II. 3	Loops: Purpose and working of loops , While loop including its working, For Loop , Nested Loops , Break and Continue.	3=2(L)+1(T)
II. 4	Function: Parts of A Function ,	3=2(L)+1(P)
II. 5	Execution of A Function ,	2=2(L)
II. 6	Keyword and Default Arguments ,Scope Rules.	2=1(L)+1(T)
III	**Strings**	**Total Lec= 26**
III. 1	Length of the string and perform Concatenation and Repeat operations in it.	2=1(L)+1 (T)
III.2	Indexing and Slicing of Strings.	6=3(L)+3(P)
III. 3	Python Data Structure : Tuples ,	4=2(L)+2(P)
III. 4	Unpacking Sequences , Lists ,	2=2(L)
III.5	Mutable Sequences , List Comprehension,sets	3=3(L)
III. 6	Dictionaries Higher Order Functions	2=2(L)
III.7	Treat functions as first class Objects , Lambda Expressions	5=3(L)+2(P)
III.8	Sieve of Eratosthenes: generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes.	4=2(L)+1(T)+1(P)
IV	**File I/O**	**Total Lec= 7**
IV.1	File input and output operations in Python Programming Exceptions and Assertions Modules	5=3(L)+2(T)
IV.2	Introduction , Importing Modules ,	2=1(L)+1(T)
V	**Data Types**	**Total Lec=6**
V.1	Abstract data types	3=2(L)+1(P)
V.2	ADT interface in Python Programming	3=3(L)
VI	**Class**	**Total Lec=18**
VI.1	Definition and other operations in the classes	3=2(L)+1(P)
VI.2	Special Methods	2=2(L)
VI.3	such as _init_, _str_, comparison methods and Arithmetic methods etc.	2=2(L)
VI.4	Class Example , Inheritance , Inheritance and OOP.	2=2(L)
VI.5	Iterators & Recursion: Recursive Fibonacci , Tower Of Hanoi Search	3=2(L)+1(T)
VI.6	Simple Search and Estimating Search Time ,	2=2(L)
VI.7	Sorting & Merging: Selection Sort , Merge List , Merge Sort , Higher Order Sort.	2=2(L)
VI.8	Introduction to python Packages	2=2(L)

15 Week Working Days. = 90 Days (Excluding Holidays) in each semester.
Each Teaching shall consist of 60 minutes time duration.

Reference Books:

(1). AshokeNamdevKamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", McGraw Hills Education
(2). E Balagurusami. "ProblrmASolving and Python Programming" Mc Geaw Hills Education.
(3). Kenneth A. Lambert, "Fundamental of Python- First Program", CENGAGE MINDTAP

Theory of Fuzzy Sets and applications		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days** **90**
I	**First Unit**	**Total Lec=30**
I. 1	Basic Concept of Fuzzy Sets & Motivation	3=2 (L)+1(T)
I. 2	Fuzzy sets and their representations	5 =3(L)+2(T)
I. 3	Membership functions and their designing	6 =4(L)+2(T)
I. 4	Type of fuzzy sets, Convex fuzzy sets	5=3(L)+2(T)
I. 5	Alpha-level cuts	5=3(L)+2(T)
I. 6	Zadeh's extension principal	3=2 (L)+1(T)
I. 7	Geometric interpretation of fuzzy sets	3=2 (L)+1(T)
II	**Second Unit**	**Total Lec= 30**
II. 1	Fuzzy relations, Projections and cylindrical extension	2=1(L)+1(T)
II. 2	Fuzzy equivalence relations, fuzzy compatibility relations	4=3(L)+1(T)
II. 3	Fuzzy ordering relations, Composition of fuzzy relations	4=3(L)+1(T)
II. 4	Fuzzy Numbers, Arithmetic operations on fuzzy numbers	4=3(L)+1(T)
II. 5	Fuzzy Logic, fuzzy propositions, fuzzy quantifiers	5=3(L)+2(T)
II. 6	Linguistic variables, Fuzzy inference	5=3(L)+2(T)
II. 7	Fuzzy measures, Possibility Theory and fuzzy sets	4=3(L)+1(T)
II. 8	Possibility theory versus probability theory	2=1(L)+1(T)
III	**Third Unit**	**Total Lec=30**
III. 1	Fuzzy mapping rules and fuzzy implication rules	4=3(L)+1(T)
III.2	Fuzzy rule-based models for function approximation and their type	6 =4(L)+2(T)
III. 3	Types: The Mamdani, TSK and standard additive models	6 =4(L)+2(T)
III. 4	Fuzzy Implications and Approximate Reasoning	5=3(L)+2(T)
III.5	Decision making in fuzzy environment: Fuzzy Decisions	3=2 (L)+1(T)
III. 6	Fuzzy linear programming, Fuzzy multi-criteria analysis	3=2(L)+1(T)
III. 7	Multi-objective decision making	3=3 (L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration. One Lecture per working Day**		

Reference Books :

(1) Fuzzy Sets and Fuzzy Logic: George Klir

(2) Fuzzy Set Theory and Its Applications: Hans-Jiirgen Zimmerman

Numerical Solution of ODE & PDE		L 60 T 30 P 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Ordinary Differential Equation**	**Total Lec= 16**
I. 1	Numerical solution of first and second order initial value problems..	3=2(L)+1(T)
I. 2	Picard's methods	4=2(L)+2(T)
I. 3	Eulers and Taylors methods	3=2(L)+1(T)
I. 4	Runge –kutta 2nd and 4th order	4=3(L)+1(T)
I. 5	Topic based Problems	2=2(L)
II	**Predictor-corrector methods**	**Total Lec=20**
II. 1	Milne's method	2=1(L)+1(T)
II. 2	Adamas-Bashforth method	4=3(L)+1(T)
II. 3	Topic based problems	3=2(L)+1(T)
II. 4	Error Analysis	2=1(L)+1(T)
II. 5	Convergence of a method	5=3(L)+2(T)
II. 6	Stability analysis	2=1(L)+1(T)
II. 7	Problems	2=1(L)+1(T)
III	**Finite Difference solution**	**Total Lec=16**
III. 1	Finite difference solution of two point boundary value problem	4=3(L)+1(T)
III.2	Solution of tridiagonal and 5-diagonal system of linear equation	2=1(L)+1(T)
III. 3	Topic based problems	2=1(L)+1(T)
III. 4	ADI METHOD	2=1(L)+1(T)
III.5	Solution of ADI method	2=1(L)+1(T)
III. 6	Topic based exercises	2=1(L)+1(T)
IV	**Finite difference Approximation to partial derivatives**	**Total Lec=10**
IV. 1	Jacobi's method	4=3(L)+1(T)
IV. 2	Gauss-seidel method	3=2(L)+1(T)
IV. 3	Worked Examples	3=1(L)+2(T)
V	**Partial Differential equations**	**Total Lec=8**
V.1	Explicit and Implicit schemes	5=3(L)+1(T)
V.2	Exercise	3=2(L)+1(T)
VI	**Numerical solution of Partial Differential Equations**	**Total Lec=20**
VI.1	Heat equation by Schmidt method,Crank-Nicolson Method	4=3(L)+1(T)
VI.2	Du fort and frankelmrthod	2=2(L)
VI.3	Solution of wave equation	5=3(L)+2(T)
VI.4	Solution of Laplace Equation	3=3(L)
VI.5	standard 5-point formulae and Diagonal 5-point formulae	4=2(L)+2(T)
VI.6	Topic based examples	2=2(L)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. Each Teaching shall consist of 60 minutes time duration.		

Reference Books:

1. Numerical Solution of Differential Equation by M.K.Jain
2. Difference Method for Initial value Problem by R.D.Richtmyer&K.W.Morton
3. Numerical Solution of Partial Differential Equations by G.D.Smith

Theory of Queues		L T P 60 30 00
Unit No.	**Unit Name**	**No. of Teachings days 90**
I	**Probability description of arrival & service times:**	**Total Lec=17**
I. 1	objectives,& different characteristics of a queuing system performance measure	2=2(L)
I. 2	Probability distribution in queueing systems	3=2(L)+1(T)
I. 3	Distribution of arrival the poisson process	5=3(L)+2(T)
I. 4	Properties of [oisson process of arrivals	3=2(L)+1(T)
I. 5	Distribution of inter arrival time.,Erlang service time distribution.	4=2(L)+2(T)
II	**Clssification of queueing models and limitation for its applications:**	**Total Lec= 20**
II. 1	steady state behavior (Equilibrium solution) of Markovian &Erlangran model (M/M/1,M/MG.,M/EK/1,EK/M/1)	3=2(L)+1(T)
II. 2	Analytical methods, numerical Procedure & randomization	2=2(L)
II. 3	techniques to study transient behavior of Markovian models	5=3(L)+2(T)
II. 4	Model I: minimum path problem.	3=2(L)+1(T)
II. 5	Model II: single additive constraints, multiplicatively separable return (General erlang queueing model)	2=2(L)
II. 6	Model III: single additive constraints, additively separable return.,	3=2(L)+1(T)
II. 7	Model: IV.(M/M/S): (∞/FCFS)	3=2(L)+1(T)
III	**Imbedded-Markov chain method to obtain steady State behavior of M/G/1, G/M/1, & M/D/C queuing system Supplementary variable techniques & its use:**	**Total Lec=19**
III. 1	Model V: (M/E_K/I): (∞/FCFS)	3=2(L)+1(T)
III.2	To find the system of steady state equations	6=3(L)+3(T)
III. 3	To find the expected number of units in the system E(L_s)	4=2(L)+2(T)
III. 4	Model VI : (M/E_K/I): (I/FCFS)	3=2(L)+1(T)
III.5	To find the system of steady state equations	3=2(L)+1(T)
III. 6	Illustrative example on Model V,VI	3=2(L)+1(T)
IV	**Machine Repair Problem:**	**Total Lec=11**
IV. 1	Model VII: (M/M/R): (K/GD), K<R	5=3(L) +2(T)
IV. 2	To find the system of steady state equations for Model VII	2=2(L)
IV. 3	Illustrative example .	4=2(L)+2 (T)
V	**Model VIII: Power Supply Model:**	**Total Lec=7**
V.1	Model VIII:	2=2(L)
V.2	To find the system of steady state equations for Model VIII	2=2(L)
V.3	Illustrative examples.	3=2(L)+1(T)
VI	**Bulk queuing system:**	**Total Lec=16**
VI.1	Transporation problems under different vehicles dispatching policies.	3=2(L)+1(T)
VI.2	Data generation & book	3=2(L)+1(T)
VI.3	Illustrative examples on Data generation	2=2(L)
VI.4	Design & control of queuing system.	2=2(L)
VI.5	Illustrative examples on control of queuing system.	3=2(L)+1(T)
VI.6	Some illustrative example on given models.	3=2(L)+1(T)
15 Week Working Days. = 90 Days (Excluding Holidays) in each semester. **Each Teaching shall consist of 60 minutes time duration.**		

Reference Books:

(1). Queuing system Vol.1 by L. Kleinrock

(2). Elements of queuing theory by T.L. Saaty

(3). Queues & Inventories by N.U. Prabhu