

Rama University, Kanpur

Ref: RU/AA SAI/soil/03

Dated: 04-06-2018

Faculty of Agricultural Sciences and Allied Industries

Minutes of Meeting

Boards of Studies

A meeting of Boards of Studies of M. Sc. Agriculture (Soil Science) was held on 04-06-2018 in Director's Office. The following members were present:

1. Dr. Rajendra Prasad - Chairperson *Rajendra Prasad*
2. Dr. Arun Shankar - Member *Arun Shankar*
3. Dr. K. K. Mishra - Member *Kishore Mishra*

The following members agreed to review the minutes in Kanpur.

1. Dr. U.S. Tiwari - External Member *U.S. Tiwari*
2. Dr. S.B. Pandey - External Member *S.B. Pandey*

Agenda:

1. To consider and approve the syllabus and evaluation scheme of for M.Sc Agriculture (Soil Science)

S. No.	Item No.	Existing	Recommendation /Action Taken
1.	To consider and approve the curriculum, syllabus and evaluation scheme of for M.Sc Agriculture (Soil Science) for students admitted in the session 2018-19	N/A	The BOS considered and approved the syllabus and evaluation scheme of for M.Sc Agriculture (Soil Science) for students admitted in the session 2018-19 Attached: Syllabus and Evaluation Scheme (Annexure:1)

2. Recommendation on New courses under the Institute

S. No.	Item No.	Feedback from Faculty/Student	Recommendation /Action Taken
1	N/A	N/A	N/A

3. Consideration of the curricula of the new programs prepared by the faculty

S. No.	Item No.	Feedback from Faculty/subject experts/Industries	Recommendation /Action Taken
1	N/A	N/A	N/A

4. Review of Teaching Process

S. No.	Item No.	Existing	Recommendation /Action Taken
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1	N/A	N/A	N/A
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5. Result Analysis: N/A

6. Any other issue with the permission of the Chair: N/A

The meeting concluded with a vote of thanks to the chair.

Date of the Next Meeting: to be decided and conveyed later


(Chairman)

Encl.: Recommended Curriculum, syllabus and evaluation scheme is attached for consideration and approval.

CC:

1. Dean Academics Office
2. Registrar Office

Department of Soil Science M.Sc. (Agri.)

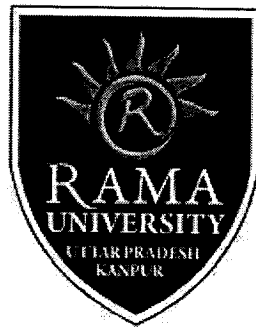
Program Educational Outcomes

- 1) To be able about physical and chemical properties of soil and their effect on plant's health.
- 2) To aware the students about causes, effects and remedies to prevention and mitigation of soil pollution.
- 3) Knowledge about soil forming rocks and minerals, their weathering and soil forming processes and climatic factors affect them.
- 4) Agricultural soil scientists develop methods that will improve the use of soil and increase the production of food and fiber crops.
- 5) Know the role of agriculture chemistry and its potential
- 6) Understand the basic concept of soil, properties of soil & its classification on the basis of pH.
- 7) Know the different plant nutrients, their functions and deficiency symptoms.
- 8) Identify the problematic soil and recommend a method for their reclamation.

RAMA UNIVERSITY

Faculty of Agricultural Sciences & Allied Industries

Department of Soil Science



ORDINANCE

For

**M.Sc. (Ag.) Soil Science
PROGRAMME**

ORDINANCE GOVERNING THE DEGREE OF MASTER OF SCIENCE (AGRICULTURE) IN Soil Science (M.Sc. (Ag.) Soil Science PROGRAM

1. DEFINITIONS OF KEY WORDS:

- (i) **University:** Rama University, Kanpur U.P.,
- (ii) **Academic Year:** Two consecutive (one odd followed by one even) semesters constitute one academic year.
- (iii) **Semester:** Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from July to December and even semester from January to June.
- (iv) There shall be subjects of studies for the Master of Science in Agriculture i.e. M. Sc. (Ag.) in Soil Science at Rama University, Kanpur (Faculty of Agricultural Sciences & Allied Industries). Introduction of any new subject(s) of studies in PG Level at the Institute will be made in due course without modification of the ordinance.
- (v) The Post-graduate Degree courses of two-year duration comprising four semesters will run under "Course and Credit System".
- (vi) A candidate seeking admission to M. Sc. (Ag.) Soil Science Programme is required to produce a certificate that he / she has passed the four-year B. Sc. (Ag.) Honours degree examination of Rama University or equivalent examination recognized by the ICAR and/or the UGC. The other eligibility criteria like percent of marks, OGPA etc. will be decided as per University guidelines, which may vary from time to time.
- (vii) The candidate admitted for admission to the M.Sc. (Ag.) Soil Science Programme shall abide by the regulations regarding the course curricula and the academic standards as prescribed by the University from time to time.
- (viii) The medium of instruction and examination shall be in English.

Department and major field of specialization: Faculty of Agricultural Sciences & Allied Industries, Rama University, Kanpur offers Master's degree in the Soil Science programme with major studies in:

M. Sc. (Ag.)	Major subject(s)
Soil Science	Refer course curriculum

2. Standing Committee (PG Programme):

- a. A Standing Committee (PG Programme) shall be formed for examining the issues related to M. Sc. (Ag.) Soil Science Programme of the Faculty.
- b. **The composition of the Standing Committee (PG Programme) shall be**
 - i. **Chairman:** A Senior Professor appointed by the Dean of the Faculty.
 - ii. Head of the Department.
 - iii. PG Coordinator of each M. Sc. (Ag.) Soil Science Programme.
- c. **Function of Standing Committee (M.Sc. (Ag.) Soil Science Programme) may include:**
 - i. Looking after the general work of M. Sc. (Ag.) Soil Science Programme.
 - ii. Reviewing academic standards including syllabus, examinations etc.
 - iii. Looking after matters related to examinations, evaluation etc.

3. PG Coordinator:

- a. BOS/Departmental Committee of the Department offering M. Sc. (Ag.) Soil Science Programme, may select a faculty member as a PG Coordinator for course.
- b. The Course Coordinator will look after smooth running of M. Sc. (Ag.) Programme of the

Handwritten signatures and initials in blue ink:
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H. S. Singh
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Department.

4. Academic Session and Semester Calendar:

- a. The duration of M. Sc. (Ag.) Soil Science Programme shall be of two academic years consisting of four semesters. The maximum allowable semesters for completion of M. Sc. (Ag.) Soil Science Programme is eight (8).
- b. The academic year of M. Sc. (Ag.) Soil Science Programme shall be in terms of two semesters in a year. The odd semesters (i.e. First and Third) shall run in the first half of an academic year and even semesters (i.e. Second and Fourth) shall run in the second half of the same academic year. The broad schedule of two semesters is:

Odd semesters (I & III)	July to December
Even semesters (II & IV)	January to June

- c. The commencement of each semester in a particular academic year shall be decided by the Standing Committee (PG Programme) from time to time.
- d. There shall be no semester break but summer and autumn recesses and enlisted holidays will be followed as prescribed by the University.

5. Courses:

- a. Code: Each course shall bear a distinguishing code (three letters and three digits) that identifies the discipline from which it is being offered.

b. Code numbers:

- i. Master seminar shall be designated by Code No. MSS-400
- ii. Master's research (Thesis shall be designated by Code No. MSS-401
- c. There shall be four types of credit courses, "only theory courses", "only practical courses", "composite courses" and "Master seminar". The composite courses will consist of both theory and practical components.
- d. The distribution of marks in various courses of M. Sc. (Ag.) shall be:

i.	For 'only theory courses' Semester Terminal Examination Internal Assessment Total	 60 40 100
ii.	For 'only practical courses' Semester Terminal Practical Examination Internal Assessment Total	 50 50 100
iii.	For 'Composite courses' i.e. Theory & Practical (100:100) Semester Terminal Theory Examination Internal Assessment (Theory) Internal Assessment (Practical) Semester Terminal Practical Examination Total	 60 40 50 50 200
iv.	For 'Master seminar'	100

e. Internal assessment:

Internal assessment will be done in the form of Continuous Evaluation having at least two tests of different forms (tutorial, class test as objective, essay, viva-voce, quiz type, assignment/term paper, class seminar, group discussion, interaction, small projects etc.) per course. The tests should be spread throughout the Semester but 15 days before the commencement of Terminal Examination. At least 50 % weightage should be on written form of tests. In case of the student who fails to appear in the Terminal examination of a given semester but appears in Internal Assessment (continuous

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evaluation) of the courses, marks of internal assessment of the student will remain valid during his/her next chances but if a student remains absent or scores low or nil marks even in internal assessment, he/she will not be permitted to reappear for internal assessment after the semester is over.

Within 15 days of conducting the Tests, the Course Instructors will submit marks in the prescribed form in duplicate to the HoD who will sign on both the copies, keep one copy for office use and forward the other copy to the Controller Examinations. The marks of the Internal Assessment should be displayed in the Department for at least seven days before forwarding the same to the Controller Examination. Once the marks of the Internal Assessment are submitted to the Controller Examination by the Department, the marks cannot be corrected or changed.

f. Marks scored in Internal Assessment are to be mentioned separately in the Mark sheet.

g. Courses:

- i) Major courses: The discipline in which the student shall pursue major study in his/her Master Programme.
- ii) Minor courses: The discipline closely related to a student's major discipline. Split minors will be permissible.
- iii) Supporting courses: It could be any discipline excluding major considered relevant for student's research work or necessary for building his/her overall competence.
- iv) Non-credit compulsory courses: Courses are of general nature and are compulsory for M.Sc. (Ag.) Soil Science Programme. Students' require completing the course Library and information services (0+1).

One credit hour indicates one hour lecture or two hours practical work per week for the entire semester.

6. Credit Requirements:

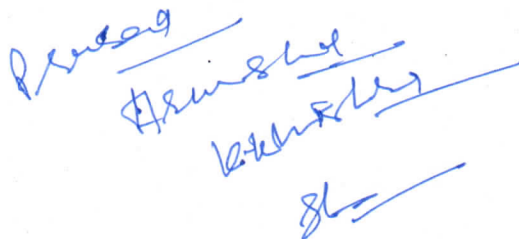
- a. A student is required to complete a minimum of 55 credits of which 35 credits shall be of course work and 20 credits shall be allocated for the research (Thesis) work.
- b. A student's programme of studies shall not be more than 25 credits in any semester.
- c. The total course and credit requirements for obtaining Degree shall be:

Particulars	Minimum Credits
i) Course Work	34
Seminar	01
Total	35
ii) Comprehensive Examination	Non-Credit
iii) Thesis	20

d. In addition to above a candidate may be permitted to opt for required number of credits from optional major courses and minor or supporting courses as suggested the Chairman of Advisory Committee.

7. Course Regulation:

- a. The courses to be offered in a particular academic year or semester shall be decided by the



BOS/HOD based on available facilities and faculty strength.

- b. Allotment of courses, designating faculties as Course Instructors and Course Associates shall be decided by the BOS/HOD well in advance of the commencement of a semester. The Course Leader will be in rotation considering the workload of each teacher associated with a particular course.
- c. Towards introduction of a new course or revision of course, University rules will be followed.
- d. There shall be no rigid rule or guideline regarding the minimum number of students required for offering a course. The course will be offered even for a single student.
- e. There shall be the provision of inviting the Guest Lecturers to deliver lecture on some highly specialized topics if required.

8. Course Registration:

The students will have to submit their choices for course(s) for a particular Semester in writing (in prescribed format) to the HOD through the Major Advisor and PG Coordinator of Department at least one week before the commencement of classes of the said Semester. Students intending to change the Course opted for once will be allowed to do so in the same process within 15 days after the initial Registration.

9. Advisory Committee:

- a. The Advisory Committee consisting of at least three members having expertise in the course subjects.
- b. Every student shall have a Major Advisor who shall be from the field to which the student has been admitted. The Major Advisor shall function as the Chairman of the Advisory Committee.
- c. The nomination for Chairman of the Advisory Committees of all newly admitted students shall be completed within four weeks of the first Semester by the HoD.
- d. The Advisory Committee of the student should meet frequently to monitor the progress of the student.
- e. A proposal for the formation of the students' Advisory Committee along with the Plan of Post-graduate Work shall be forwarded in the prescribed proforma to the HoD for approval within six weeks from the date of admission of the student.
- f. The Major Advisor will select other members of the student's Advisory Committee (with the knowledge and consent of the members concerned). Co-advisor shall be from the major field of study/specialization of the Department.
- g. Co-advisor will act as the Major Advisor of the concerned student if the original Chairman is not available due to one or more reasons (death, leaving the university, prolonged absence, ill health etc.)
- h. Replacement of members of the Advisory Committee: The Chairman of the concerned student after consultation with the HoD can replace any member of the Advisory Committee due to one or more reasons as stated in Para 9. g above.
- i. In case of newly admitted students, the HoD will discharge the functions of the Chairman of the Advisory Committee till the Chairman is selected as per procedure prescribed above.
- j. A faculty member having a minimum of one year teaching/ research experience or Doctoral degree can be the Chairman of the Advisory Committee.

10. Plan of Post-graduate Work (PPW):

- a. The programme of studies indicating the PPW of each student in prescribed format shall be finalized by his/her Advisory Committee indicating the requirement for research in that particular field.

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- b. The broad research topic of every student will be mentioned at the time of preparation of PPW. The Advisory Committee should finalize PPW within six weeks of the first Semester.

11. The Outline of Research Work (ORW):

- a. The ORW in prescribed format will have to be approved by the Advisory Committee and forwarded by the Chairman of the Committee to the HoD through the PG Coordinator.
b. The ORW will be presented in the Departmental Seminar for discussion and suggestions.

12. Attendance:

Candidates should have an average attendance of 75% in every Semester to be eligible to appear for the Terminal Examination of a given Semester.

Paper setting and Evaluation:

- a. In the Semester Terminal examination question papers for fifty percent of the courses in each semester shall be set externally and evaluated externally. But for only practical courses evaluation will jointly be made by the external and internal(s) examiners.
b. In case any external examiner fails to arrive in the practical examination, the concerned HoD may exercise the option to appoint himself or any other teacher of the University or an expert available in the vicinity other than internal examiner(s).

13. Examination and Regulation:

- a. Semester Terminal examinations for odd Semesters shall ordinarily be held in December while for even Semesters be held in the month of June in every academic year. Standing Committee (PG Programme) will fix the period of every Semester Terminal examination preferably at the beginning of the semester. It is also expected that the Semesters of M. Sc. (Ag.) Soil Science Programme in the Faculty will commence at the same time.
b. The candidates shall be required to pass all the courses mentioned in his/her PPW. He/she also needs to complete required Thesis credit hours within the stipulated period i.e. not more than eight (8) Semesters.
c. Before appearing in the end semester theory and/or practical examinations (both theory and practical examinations for composite courses) the student must pass all the backlog paper(s).
d. There shall be the provision for Review System and the evaluation will be done internally. The BoS will recommend the names of three members (HoD and other two members excluding the first examiner) for Review Examination. In case the HoD has evaluated the course, chairman will act as a member in the Board replacing the HoD.
e. The duration for semester Terminal examination of different courses shall be as follows:
i) For theory courses: 3 hours
ii) For practical courses: 3 hours
f. The candidates appearing in each Semester Terminal examination of M.Sc. (Ag.) Soil Science Programme shall: (i) produce a certificate from the HoD that he/she has attended at least 75 % of the in-campus classes. Relaxation, if any, will be guided by the University Ordinance; (ii) produce a certificate from HoD that his/her conduct has been good and that he/she is fit and proper candidate for the examination.
g. A student found adopting unfair means at the examination will be treated heavily and stringent action will be taken as per University rules.
h. No 'make up' examination shall be permitted in lieu of the missed Terminal theory and/or practical examination.

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- i. If a student fails to appear in any final theory and /or practical examination or does not secure pass marks in any course, he/she requires fresh registration for the course during the next available Semester with that course but the candidate has to complete the degree programme including all the repeat courses within eight (8) Semesters.
- j. If a candidate is compelled to drop a Semester on medical ground he/she will be allowed to repeat in the next available Semester. However, he/she has to complete all the courses within eight (8) Semesters.
- k. If a student has to drop a course on medical ground but having less than 75 % attendance the student shall be given 'I' grade, i.e. "incomplete", and will be allowed to repeat the course in the next available Semester. The 'I' grade shall be entered in the transcript also. In all other cases dropping of course will be declared 'Fail' in the course.

14. Fees and other Charges:

Student admitted to M.Sc. (Ag.) Soil Science Programme shall pay examination fees (as per University guidelines) for each Semester Terminal Examination at the time of filling up of form for the purpose.

15. Moderation:

- a. A Moderation Committee consists of at least three members may be appointed as per University rule but excluding an external moderator, shall do moderation of question papers for the Terminal Theory Examinations.
- b. Separate Moderation Committee shall be formed for each M. Sc. (Ag.) Programme and that may act under the Chairmanship of HoD.

16. Scrutiny:

- a. There shall be a Scrutiny Committee consisting of HoD and two other teachers of the Department to scrutinize the results of internal assessment, Terminal as well as Review examinations before finalization. The BoS of the concerned Department will approve the Committee.
- b. M.Sc. (Ag.) Soil Science Programme will have separate Scrutiny Committee that will act independently.

17. Master Seminar:

- a. Each student shall be required to deliver a Seminar during the course of studies on a topic relevant to the concerned discipline.
- b. Code No. 400 shall be assigned for Course Seminar.
- c. PG Coordinator shall act as Seminar Leader. Otherwise, HoD of Department himself or may select any faculty member as Seminar Leader.
- d. Departmental students' Seminar will be an open Seminar.
- e. The Seminar Leader in consultation with the HoD shall fix the schedule for the Seminars.
- f. The Seminar topic shall not be within the purview of the student's Thesis instead should cover a subject of topical interest.
- g. Each student will prepare and distribute copies of 'Abstract' to the persons attending the Seminar. The Abstract (within 300 words) should precisely state the main theme of the talk.
- h. Seminar evaluation: Seminar Leader and the members of the Advisory Committee will evaluate the performance of the students, taking into account all the relevant factors like, Introduction, Review of Literature, presentation of subject, capacity to draw general conclusion from literature and ability to answer questions raised and will award marks to the student.

18. Comprehensive:

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- a. Every student has to appear at Comprehensive Examination to be conducted by the Advisory Committee.
- b. A candidate should be allowed for comprehensive examination after completion of 75% course work separately in subject(s) but before the submission of Thesis.
- c. Written comprehensive examination consists of one paper of three hours duration having 100 marks.
- d. Paper setting and evaluation will be done internally.
- e. Qualifying marks will be 50% and grading will be Satisfactory/Unsatisfactory. If the performance of a student becomes unsatisfactory he/she has to appear again to a maximum of three more attempts within eight (8) Semesters. Repeat comprehensive test (s) shall be conducted at least with a gap of 30 days of the previous test.
- f. The results of comprehensive examination shall be forwarded by the HoD to the Examination Section for record. The grade obtained will not be reflected in the Final transcript.

19. Thesis:

- a. The thesis for the Master's Degree shall indicate student's potentialities for conducting research.
- b. The topic of Thesis will be within the Field of specialization under the Code No. 401.
- c. The subject of the Thesis should be approved by the student's Advisory Committee and the HoD at the time of formation of the student's PPW and then ORW.
- d. The Thesis shall be based on the results of the student's own work. A certificate to this effect from the Major Advisor shall accompany the Thesis.
- e. The Thesis shall preferably follow the following: chapters on Introduction, Review of literature, Materials and Methods, Results, Discussion, Conclusion and Summary, Future scope of research and References.
- f. **Thesis Seminar:** A student shall deliver a seminar on the research problem before the submission of Thesis and all the faculty members may be invited to participate in the discussion and make constructive suggestions on the Thesis.
- g. Thesis submission: After fulfilling the prescribed courses, residential requirements and minimum semester requirements (4 Semesters) and successfully completing the research work to the level of full satisfaction, a student shall submit the Thesis.
- h. The Chairman of the student's Advisory Committee shall ensure that all members of the Advisory Committee are duly consulted before submission of the manuscript of the Thesis.
- i. Each student shall submit three copies of the Thesis within the date notified by concerned HOD, one copy to deposit to the Institute Library, another to the Departmental Library, third to the Major Advisor.
- j. The Thesis shall accompany a certificate to the effect that the work has not been submitted in part or full for any other degree or diploma.
- k. The candidate shall submit the Thesis to the concerned HoD along with "no dues certificate" and other formalities.
- l. **Thesis Viva-Voce:** An External Examiner shall examine the Thesis. An arrangement for viva voce shall be made by the concerned Department by an Examination Committee consisted of External Examiner, HoD and the members of the Advisory Committee of the candidate. The student shall be awarded satisfactory i.e. pass or non satisfactory i.e, fail in Thesis Viva- Voce.
- m. The grade obtained i.e. satisfactory or unsatisfactory shall be shown in the final transcript but shall not be included for the purpose of calculation of OGPA.
- n. In case, the External Examiner suggests modification/re-submission, the student may be permitted to defend his/her thesis in final viva-voce, and as such of modifications as are finally agreed upon may be carried out after the viva-voce.

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- o. Re-examination: If a student fails in Thesis he/she may be permitted to continue the work and/or rewrite the Thesis as per comments of the Examination Committee and resubmit it to the HoD with the recommendation of the Chairman of the Advisory Committee for permission to appear a second time. Re-examination shall not take place earlier than three months after the final semester examination but within eight (8) Semesters and as far as possible the Committee as previously constituted, will conduct it. No further reexamination is permissible and a student failing to secure 'satisfactory' grade a second time shall not qualify for the degree

20. Rights on Thesis:

- a. The Thesis submitted by a student shall become the property of the Institute.
b. Whenever, an extract from the Thesis is published, there should be an acknowledgement in the form of footnote stating that the results are from the Thesis submitted for the degree from the Faculty of Agricultural Sciences & Allied Industries, Rama University.
c. All patents, designs and inventions derived from the Thesis research work shall belong to the Faculty which may, at its discretion, allow or direct any benefit thereon to be retained by or given to the author of the Thesis.
d. Copies of the Thesis submitted to the University Library or in the Departmental Library shall not be issued on loan for a period of two years from the date of submission.
e. In case where student does not take care to publish the Thesis work even after three years of completion of the degree, there stands no objection of the student to publish papers/articles by the Chairman, Advisory Committee of the concerned student.

21. Grading System:

- a. There will be a ten point grading system of evaluation with grade point (GP) equals to percent marks obtained divided by 10.
b. **The conversion formula will be:** Percent of marks = 10 x OGPA
c. Minimum requirement: Grade point (GP) of 5.00 for passing a course and an Overall Grade Point Average (OGPA) of 5.00 for completing the M. Sc (Ag.) Soil Science Programme. A candidate failing to secure minimum OGPA (5.00) will not be considered for the award of degree and shall be declared as 'failed'. If a candidate fails to secure 40 % marks in Practical examination of composite course he /she will be declared as 'fail' in the concerned course.
d. A candidate failing to obtain minimum GP (5.00) in not more than three courses, in a Semester, will be allowed to repeat the failed course(s) afresh not more than two times in next available Semesters. A candidate failing in more than three courses in a Semester has to repeat the Semester. In any circumstance the student is to complete the degree Programme including all the repeat courses within the maximum of 08 Semesters.
e. Symbols to be used in the Semester Transcript:

I = Incomplete

R = Repeat

Specialization of the candidate needs to be mentioned in the Semester Mark sheet/Transcript.

22. Residential Norms:

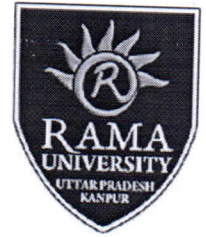
- a. Residential requirement shall mean presence of the student continuously in working days/hours in the Institute/University (class room for classes, laboratories for practical and/or research, farm for field work, library for collecting information or placed somewhere on duties etc.).
b. The minimum residential requirement shall be of four Semesters from the date of admission to the University. However, with the prior written permission of the HoD, PSB through the Chairman a student may be allowed to discontinue after completion of two consecutive

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Semesters and renew studies even after two Semesters. Completion of semester shall mean clearing of all examinations as scheduled. He/she has to pay annual fees for the University for Retention of the studentship.

- c. A student may be allowed for discontinuance only by one break and he/she shall have to complete all courses including submission of Thesis within eight semesters from the date of admission to the University, failing which his/her studentship shall be treated as cancelled.
- d. A student appealing discontinuance for one or two semester(s) has to vacate hostel accommodation.

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EVALUATION SCHEME

M.Sc.(Ag.) SOIL SCIENCE FIRST YEAR (SEMESTER-I) (2018-19)

S.N.	Subject Code	Subject Name	Period			Evaluation Scheme			Subject Total	Credit Hours
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	MSS-101	SOIL PHYSICS	2	0	0	20	20	60	100	2
2	MSS-102	SOIL FERTILITY AND FERTILIZER USE	3	0	0	20	20	60	100	3
3	MSS-103	SOIL CHEMISTRY	2	0	0	20	20	60	100	2
4	MSS-104	SOIL MICROBIOLOGY (To be taught jointly by Soil Science and Microbiology)	2	0	0	20	20	60	100	2
5	MSA-103	PRINCIPLES AND PRACTICES OF ORGANIC FARMING	3	0	0	20	20	60	100	3
Practicals / Project										
6	MSS-151	SOIL PHYSICS	0	0	1	30	20	50	100	1
7	MSS-152	SOIL FERTILITY AND FERTILIZER USE	0	0	1	30	20	50	100	1
8	MSS-153	SOIL CHEMISTRY	0	0	1	30	20	50	100	1
9	MSS-154	SOIL MICROBIOLOGY	0	0	1	30	20	50	100	1
10	MSA-153	PRINCIPLES AND PRACTICES OF ORGANIC FARMING	0	0	1	30	20	50	100	1
Total			12	12	05	250	200	550	1000	17

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

• **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1 Attendance: 5 Marks

2 Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

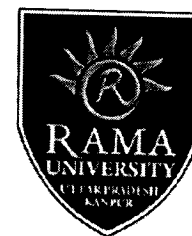
a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks



M.Sc.(Ag.) SOIL SCIENCE FIRST YEAR (SEMESTER-II)

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory subjects										
1	MSS-201	SOIL MINERALROGY GENESIS AND SURVEY	2	0	0	20	20	60	100	2
2	MSS-202	SOIL, WATER AND AIR POLLUTION	2	0	0	20	20	60	100	2
3	MSS-203	MANAGEMENT OF PROBLEMATIC SOILS	2	0	0	20	20	60	100	2
4	MSS-204	CROP PHYSIOLOGY	2	0	0	20	20	60	100	2
5	MSS-205	FIELD PLOT TECHNIQUES	2	0	0	20	20	60	100	2
Practicals / Project										
6	MSS-251	SOIL MINERALROGY GENESIS AND SURVEY	0	0	1	30	20	50	100	1
7	MSS-252	SOIL, WATER AND AIR POLLUTION	0	0	1	30	20	50	100	1
8	MSS-253	MANAGEMENT OF PROBLEMATIC SOILS	0	0	1	30	20	50	100	1
9	MSS-254	CROP PHYSIOLOGY	0	0	1	30	20	50	100	1
10	MSS-255	FIELD PLOT TECHNIQUES	0	0	1	30	20	50	100	1
Total			10	0	5	250	200	550	1000	15

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

• **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1 Attendance: 5 Marks

2 Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks



M.Sc.(Ag.) SOIL SCIENCE (SEMESTER-III)

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	PGS- 301	History of Agriculture	1	0	0	20	20	60	100	1
2	MSS-302	Basic Statistical methods in Agriculture	2	0	0	20	20	60	100	3
3	MSS-303	Library and information services	0	0	0	0	0	0	0	0
Practical										
4	MSS-302	Basic Statistical methods in Agriculture	0	0	1	30	20	50	100	1
5	MSS-303	Library and information services	0	0	1	30	20	50	100	1
Total			3	0	2	100	80	220	400	6

L-Lecture, T-Tutorial, P- Practical, CE- Continuous Evaluation, MTE-Mid Term Examination, ETE-End Term Examination

• **Course without practical components**

For Continuous Evaluation (CE) is such as: 20 Marks

1 Attendance: 5 Marks

2 Assignments/Quiz / Seminar/Term paper /Project :15Marks

MTE - Mid Term Examination: 20 Marks

a. First Mid Term Examination: 10 marks

b. Second Mid Term Examination: 10 marks

ETE - End Term Examination: 60 Marks

• **Course with practical components only**

For Continuous Evaluation (CE) is such as: 30 Marks



M.Sc.(Ag.) SOIL SCIENCE (SEMESTER-IV)

S.N.	Subject Code	Subject Name	Period			EVALUATION SCHEME			Subject Total	Credit
			L	T	P	CE	MTE	ETE		
Theory Subjects										
1	MSS- 401	Comprehensive Examination, Master's Research (Research Work & Thesis/Project)	0	0	0	0	0	200	200	0
Practical/Project										
2	MSS 400	Master Seminar	0	0	1	100	0	0	100	1
3	MSS- 451	Comprehensive Examination, Master's Research (Research Work & Thesis/Project)	0	0	20	300	0	0	300	20
Total			0	0	21	400	0	200	600	21

Convener

Signature: Dr. Rajendra Prasad
Name : Dr. Rajendra Prasad
Date :

Internal Members

Signature: 1. Dr. Arun Shankar
Name: Dr. Arun Shankar
Date:

2. Dr. K. K. Mishra
Dr. K. K. Mishra

External Members

Signature: 1. Dr. U. S. Tiwari
Dr. U. S. Tiwari

2. Dr. S. B. Pandey
Dr. S. B. Pandey



EVALUATION SCHEME

&

SYLLABUS

FOR

M. Sc. AGRICULTURE

SOIL SCIENCE

w.e.f 2018-19



MSS-101: SOIL PHYSICS

Course objective:- To express basic information about physical soil properties and processes related to crop growth	L	T	P	CR
	2	0	1	3

Detail Contents

Unit 1:	35%
Unit 2:	35%
Unit 3:	15%
Unit 4:	15%

Theory

Unit-I: Scope of soil physics and its relation with other branches of soil science; soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts. Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting - mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation.

Unit-II: Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil moisture characteristic curve; hysteresis, measurement of soil-moisture potential. Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils. Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum.

Unit-III: Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management.

Unit-IV: Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.

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Practical

- Mechanical analysis by pipette and international methods
- Measurement of Atterberg limits
- Aggregate analysis - dry and wet
- Measurement of soil-water content by different methods
- Measurement of soil-water potential by using tensiometer and gypsum blocks
- Determination of soil-moisture characteristics curve and computation of pore-size distribution
- Determination of hydraulic conductivity under saturated and unsaturated conditions
- Determination of infiltration rate of soil
- Determination of aeration porosity and oxygen diffusion rate
- Soil temperature measurements by different methods • Estimation of water balance components in bare and cropped fields

Course Learning Outcomes (CLO)

Through this course students should successfully:

- Hypothesize the basic concepts of soil physics
- Outline the physical characteristics of soils
- Illustrate the attributes of soil water and its movement
- Evaluate soil air composition, its movement and management
- Assess thermal properties of soils
- describe soil-plant-water relationship

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
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CLO									
CLO ₁	3	2	-	1	3	3	2	-	3
CLO ₂	3	2	-	1	3	3	2	-	3
CLO ₃	3	2	-	1	3	3	2	-	3
CLO ₄	3	2	-	1	3	3	2	-	3
CLO ₅	3	2	-	1	3	3	2	-	3
CLO ₆	3	2	-	1	3	3	2	-	3
Average	3	2	-	1	3	3	2	-	3

Text books:- Hillel D. 1980. Fundamentals of Soil Physics. Academic Press.

Lal R & Shukla MK. 2004. Principles of Soil Physics. Marcel Dekker.

Reference books:-

Indian Society of Soil Science. 2002. Fundamentals of Soil Science. ISSS, New Delhi.

Kirkham D & Powers WL. 1972. Advanced Soil Physics. Wiley-Interscience.

Kohnke H. 1968. Soil Physics. McGraw Hill.

Signature:-

1. Prasad
2. Arun Chandra
3. K. K. Mishra
4. H. S. G. S.
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MSS- 102: SOIL FERTILITY AND FERTILIZER USE

Course objective:- To inform students about soil fertility, and to recognize the role of fertilizers and manures in supplying plants with nutrients so that high fertilizer use efficiency is achieved.

L	T	P	CR
3	0	1	4

Detail Contents

Unit 1:	10%
Unit 2:	20%
Unit 3:	15%
Unit 4:	20%
Unit 5:	10%
Unit 6:	25%

Theory

Unit-I: Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms.

Unit-II: Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency.

Unit-III: Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions.

Unit-IV: Potassium - forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions. Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium– factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers.

Unit-V: Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability.

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Unit-VI: Common soil test methods for fertilizer recommendations; quantity– intensity relationships; soil test crop response correlations and response functions. Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management. Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

Practical

- Principles of colorimetry
- Flame-photometry and atomic absorption spectroscopy
- Chemical analysis of soil for total and available nutrients
- Analysis of plants for essential elements

Course Learning Outcomes (CLO)

Through this course students should successfully:

- Discuss soil fertility
- Analyze the role of manures and fertilizers as source of nutrients to plants
- Review nutrients' recycling in agro ecosystem
- Illustrate the critical concentration and forms of soil nutrients
- Explain the methods of soil fertility evaluation and fertilizer recommendation

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO									
CLO₁	3	2	-	1	3	3	2	-	3
CLO₂	3	2	-	1	3	3	2	-	3
CLO₃	3	2	-	1	3	3	2	-	3
CLO₄	3	2	-	1	3	3	2	-	3
CLO₅	3	2	-	1	3	3	2	-	3
Average	3	2	-	1	3	3	2	-	3

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Anshul
Kishore
Tiwari
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Text books:-

Tisdale SL, Nelson SL, Beaton JD & Havlin JL. 1999. Soil Fertility and Fertilizers. 5th Ed. Prentice Hall of India.

Stevenson F J & Cole M A. 1999. Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons.

Reference books:-

Kabata-Pendias A & Pendias H. 1992. Trace Elements in Soils and Plants. CRC Press. Kannaiyan S, Kumar K &



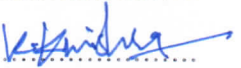


Govindarajan K. 2004. Biofertilizers Technology. Scientific Publ.

Leigh JG. 2002. Nitrogen Fixation at the Millennium. Elsevier. Mengel K & Kirkby EA. 1982. Principles of Plant Nutrition. International Potash Institute, Switzerland.

Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. Micronutrients in Agriculture. 2nd Ed. SSSA, Madison.

Pierzinsky GM, Sims TJ & Vance JF. 2002. Soils and Environmental Quality. 2nd Ed. CRC Press.

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MSS- 103: SOIL CHEMISTRY

Course objective:- To present the concept of soil chemistry and to acclimate students with current advancements in soil chemistry with regard to utilizing soils as a medium for crop growth.

L	T	P	CR
2	0	1	3

Detail Contents

Unit 1:	10%
Unit 2:	25%
Unit 3:	25%
Unit 4:	10%
Unit 5:	15%
Unit 6:	15%

Theory

UNIT-I: Chemical (elemental) composition of the earth's crust and soils. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics.

UNIT-II: Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, clay-organic interactions.

UNIT-III: Ion exchange processes in soil; cation exchange- theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange – innersphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition.

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UNIT-IV: Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption; precipitation-dissolution equilibria; step and constant-rate K; management aspects.

UNIT-V: Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity. Chemistry and electrochemistry of submerged soils.

UNIT-VI: Chemistry of salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments.

Practical

- Determination of CEC and AEC of soils
- Analysis of equilibrium soil solution for pH, EC, Eh by the use of Eh-pH meter and conductivity meter • Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method
- Potentiometric and conductometric titration of soil humic and fulvic acids
- (E4/E6) ratio of soil humic and fulvic acids by visible spectrophotometric studies and the \bar{A} (E4/E6) values at two pH values
- Adsorption-desorption of phosphate/sulphate by soil using simple adsorption isotherm
- Construction of adsorption envelope of soils by using phosphate/fluoride/sulphate and ascertaining the mechanism of the ligand exchange process involved
- Determination of titratable acidity of an acid soil by BaCl₂-TEA method
- Determination of lime requirement of an acid soil by buffer method
- Determination of gypsum requirement of an alkali soil

Course Learning Outcomes (CLO)

Through this course students should successfully:

- illustrate the chemical composition of the earth's crust and soils
- review concepts in soil chemistry
- Associate soil chemical processes with nutrient availability.

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- discuss mechanisms of fixation of nutrient in soil and its impact on nutrient availability
- assess the phenomena and models of cationic and anionic exchange

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO									
CLO₁	3	2	-	1	3	3	2	-	3
CLO₂	3	2	-	1	3	3	2	-	3
CLO₃	3	2	-	1	3	3	2	-	3
CLO₄	3	2	-	1	3	3	2	-	3
CLO₅	3	2	-	1	3	3	2	-	3
Average	3	2	-	1	3	3	2	-	3

Text books:-

Bear RE. 1964. Chemistry of the Soil. Oxford & IBH.

Bolt GH & Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.

Sposito G. 1989. The Chemistry of Soils. Oxford Univ. Press.

Reference books:-

Stevenson FJ. 1994. Humus Chemistry. 2nd Ed. John Wiley & Sons.

Van Olphan H. 1977. Introduction to Clay Colloid Chemistry. John Wiley & Sons.

Greenland DJ & Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.

Greenland DJ & Hayes MHB. Chemistry of Soil Constituents. John Wiley & Sons.

McBride MB. 1994. Environmental Chemistry of Soils. Oxford Univ. Press.

Sposito G. 1981. The Thermodynamics of Soil Solutions. Oxford Univ. Press. Sposito G. 1984. The Surface Chemistry of Soils. Oxford Univ. Press.

Handwritten signatures:
 J. K. Singh
 Anil Kumar
 K. B. N. Singh
 J. K. Singh
 J. K. Singh



MSS- 104: SOIL MICROBIOLOGY

Course objective:-

To impart knowledge on role of soil microbes in nutrient recycling and to give an overview on microbial ecology-microbial habitats, their interactions and plant-microbe relationship

L	T	P	CR
2	0	1	3

Detail Contents

Unit 1:	10%
Unit 2:	25%
Unit 3:	25%
Unit 4:	40%

Theory

Unit-I: Soil biota, Soil microbial ecology, types of organisms in different soils; Soil microbial biomass; Microbial interactions: unculturable soil biota.

Unit-II: Microbiology and biochemistry of root - soil interface; phyllosphere, Biofertilizers, soil enzyme activities and importance.

Unit-III: Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil. Biochemical composition and biodegradation of soil organic matter and crop residues.

Unit-IV: Biodegradation of pesticides, Organic wastes and their use for production of biogas and manures: Biotic factors in soil development.

Practical

- Determination of soil microbial population
- Determination of Soil microbial biomass
- Determination of Decomposition studies in soil
- Determination of Soil enzymes
- Measurement of important soil microbial processes such as ammonification, nitrification, N₂ fixation, S oxidation, P solubilization and mineralization of other micro-nutrients
- Study of rhizosphere effect.

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Course Learning Outcomes (CLO)

Through this course students should successfully:

- describe beneficial effects of soil microorganisms on soil health and balancing the soil ecosystem
- illustrate transformation of nutrients and humic substances by soil microorganisms
- review plant-microbe interactions

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	3	2	-	1	3	3	2	-	3
CLO ₂	3	2	-	1	3	3	2	-	3
CLO ₃	3	2	-	1	3	3	2	-	3
Average	3	2	-	1	3	3	2	-	3

Text books:-

Introduction to soil microbiology. 1977. Martin Alexander. John Wiley Publication.

Subba Rao N S. Soil Microbiology. Enfield Science Publishers, 1999.

Reference books:-

Stevenson FJ. 1994. Humus Chemistry. 2nd Ed. John Wiley & Sons.

Paul EA. 2007. Soil Microbiology, Ecology and Biochemistry. 3rd ed. Academic Press.

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MSS-201: SOIL MINERALOGY, GENESIS AND SURVEY

Course objective:-	L	T	P	CR
To familiarize students with genesis of soil and structure of associated minerals and impart knowledge about conduction of soil survey and interpretation of associated data for effective land use planning.	2	0	1	3

Detail Contents

Unit 1: 20%

Unit 2: 20%

Unit 3: 20%

Unit 4: 20%

Unit 5: 20%

Theory

Unit-I: Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism. Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystalline and non-crystalline clay minerals; identification techniques; amorphous soil constituents and other non-crystalline silicate minerals and their identification; clay minerals in Indian soils.

Unit-II: Factors of soil formation, soil formation models; soil forming processes; weathering of rocks and mineral transformations; soil profile; weathering sequences of minerals with special reference to Indian soils.

Unit-III: Concept of soil individual; soil classification systems – historical developments and modern systems of soil classification with special emphasis on soil taxonomy; soil classification, soil mineralogy and soil maps – usefulness.

Unit-IV: Soil survey and its types; soil survey techniques - conventional and modern; soil series – characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; soil mapping, thematic soil maps, cartography, mapping units, techniques for generation of soil maps.

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Unit-V: Landform – soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT) – concept and application; approaches for managing soils and landscapes in the framework of agro-ecosystem.

Practical

- Identification and quantification of minerals in soil fractions
- Morphological properties of soil profile in different landforms
- Classification of soils using soil taxonomy
- Calculation of weathering indices and its application in soil formation
- Grouping soils using available data base in terms of soil quality
- Aerial photo and satellite data interpretation for soil and land use
- Cartographic techniques for preparation of base maps and thematic maps, processing of field sheets, compilation and obstruction of maps in different scales
- Land use planning exercises using conventional and RS tools

Course Learning Outcomes (CLO)

Through this course students should be able to:

- Illustrate factors and processes of soil formation.
- Assess structure and genesis of clay minerals.
- Review properties of clay minerals.
- Discuss soil classification and its importance.
- Explain soil survey and soil survey reports
- Describe major soil groups of India

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Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	3	2	-	1	3	3	2	-	3
CLO ₂	3	2	-	1	3	3	2	-	3
CLO ₃	3	2	-	1	3	3	2	-	3
CLO ₄	3	2	-	1	3	3	2	-	3
CLO ₅	3	2	-	1	3	3	2	-	3
CLO ₆	3	2	-	1	3	3	2	-	3
Average	3	2	-	1	3	3	2	-	3

Text books:-

Introductory pedology : soil genesis, survey and classification. 1986. Sehgal J L. Kalyani Publishers

Grim RE. 1968. Clay Mineralogy. McGraw Hill

Reference books:-

USDA. 1999. Soil Taxonomy. Hand Book No. 436. 2nd Ed. USDA NRCS, Washington.

Wade FA & Mattox RB. 1960. Elements of Crystallography and Mineralogy. Harper & Brothers, New York.

Signature:-

1. Prasad
2. Anurag Kumar
3. Jeetendra Singh
4. Himanshu
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MSS-202: SOIL WATER AND AIR POLLUTION

L	T	P	CR
2	0	1	3

Course objective:- Making the students aware of the soil, water and air pollution problems involved with the use of soil for crop production.

Detail Contents

Unit 1:	20%
Unit 2:	20%
Unit 3:	20%
Unit 4:	20%
Unit 5:	20%

Theory

Unit-I: Soil, water and air pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

Unit-II: Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal.

Unit-III: Pesticides – their classification, behavior in soil and effect on soil microorganisms. Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health.

Unit-IV: Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases – carbon dioxide, methane and nitrous oxide.

Unit-V: Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.

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Practical

- Sampling of sewage waters, sewage sludge, solid/liquid industrial wastes, polluted soils and plants
- Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD), nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents
- Heavy metals in contaminated soils and plants
- Management of contaminants in soil and plants to safeguard food safety
- Air sampling and determination of particulate matter and oxides of sulphur
- Visit to various industrial sites to study the impact of pollutants on soil and Plants

Course Learning Outcomes (CLO)

Through this course students should successfully

- identify soil, water and air pollution problems
- interpret criteria of soil, water and air quality data
- assess transformations of pollutants

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO									
CLO₁	3	2	3	1	3	3	1	-	3
CLO₂	3	2	3	1	3	3	1	-	3
CLO₃	3	2	3	1	3	3	1	-	3
Average	3	2	3	1	3	3	1	-	3

Text books:-

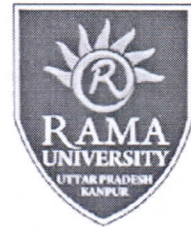
Ross SM. Toxic Metals in Soil Plant Systems. John Wiley & Sons.

Vesilund PA & Pierce 1983. Environmental Pollution and Control. Ann Arbor Science Publ.

Reference books:-

Middlebrooks EJ. 1979. Industrial Pollution Control. Vol. I. Agro-Industries. John Wiley Interscience.

Prasanna
Anshu
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MSS-203: MANAGEMENT OF PROBLEMATIC SOILS

Course objective:-	L	T	P	CR
To impart concepts of problematic soils, brackish water, and their management with respect to crop production.	2	0	1	3

Detail Contents

Unit 1:	15%
Unit 2:	35%
Unit 3:	25%
Unit 4:	25%

Theory

UNIT-I: Area and distribution of problem soils – acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible.

Unit-II: Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties. Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils.

Unit-III: Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.

Unit-IV: Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent; relationship in water use and quality. Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters.

Practical

- Characterization of acid, acid sulfate, salt-affected and calcareous soils

Practical
Answer
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H. W. Singh



- Determination of cations (Na⁺, K⁺, Ca⁺⁺ and Mg⁺⁺) in ground water and soil samples
- Determination of anions (Cl⁻, SO₄⁻⁻, CO₃⁻⁻ and HCO₃⁻) in ground waters and soil samples
- Lime and gypsum requirements of acid and sodic soils

Course learning outcomes (CLO)

Though this course the students should successfully:

- Examine soil quality and health
- identify distribution of Waste land and problem soils in India
- review reclamation and management of soils with physical, chemical and biological constraints
- Illustrate standards of quality of irrigation water and utilization of brackish water in agriculture.
- explain bio remediation of soils through Multipurpose tree species

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	3	2	-	1	3	3	2	-	3
CLO ₂	3	2	-	1	3	3	2	-	3
CLO ₃	3	2	-	1	3	3	2	-	3
CLO ₄	3	2	-	1	3	3	2	-	3
CLO ₅	3	2	-	1	3	3	2	-	3
Average	3	2	-	1	3	3	2	-	3

Text books:-

Jurinak JJ. 1978. *Salt-affected Soils*. Department of Soil Science & Biometeorology. Utah State Univ.

Bear FE. 1964. *Chemistry of the Soil*. Oxford & IBH.

Reference books:-

USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline and Alkali Soils*. Oxford & IBH.

Richards L.A USDA Handbook No. 60. 1954. *Diagnosis and improvement of Saline and Alkali Soils*. Oxford & IBH.



ISSS (2009) *Fundamentals of Soil Science*, Div. of Soil Science, IARI, New Delhi.

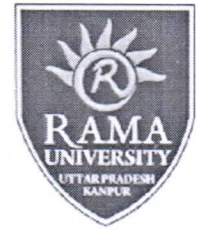
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Tiwari



Cirsan Paul, J.(1985) Principles of remote sensing. Longman, New York. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, New Delhi.

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MSS-204: Crop Physiology

	L	T	P	CR
Course objective:-	2	0	1	3

To impart knowledge about crop growth, development and interaction with environment with respect to physiological processes.

Detail Contents

Unit 1:	10%
Unit 2:	15%
Unit 3:	15%
Unit 4:	15%
Unit 5:	15%
Unit 6:	15%
Unit 7:	15%

Theory

Unit I

Cell organelles and their physiological functions, structure and physiological functions of cell wall, cell inclusions; cell membrane structure and functions.

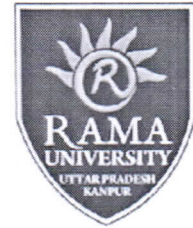
Unit II

Soil and plant water relations, water and its role in plants, properties and functions of water in the cell water relations-cell water terminology, water potential of plant cells. Mechanism of water uptake by roots-transport in roots, aquaporins, movement of water in plants – Mycorrhizal association on water uptake. Water loss from plants-Energy balance-Solar energy input-energy dissipation at crop canopy level- evapotranspiration, transpiration –Driving force for transpiration, plant factors influencing transpiration rate.

Unit III

Stomata structure and function – mechanism of stomatal movement, antitranspirants.

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Arshdeep
Kishore
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Physiology of water stress in plants: Influence of water stress at cell, organ, plant and canopy levels. Indices for assessment of drought resistance. The role of mineral nutrients in plant metabolism: Essential elements, classification based on function of elements in plants.

Unit IV

Uptake of mineral elements in plants –Mechanisms of uptake-translocation of minerals in plants. Physiological and metabolic functions of mineral elements, critical levels, deficiency symptoms, nutrient deficiency and toxicity. Foliar nutrition.

Unit V

Photosynthesis and its importance in bio productivity. Photochemical process, photochemical reactions, CO₂ reduction in Calvin cycle, supplementary pathway of C fixation in C₄ and CAM plants and its significance. Photorespiration and its relevance. Photosynthesis as a diffusive process, effect of environmental factors on photosynthetic rates. Synthesis of sucrose, starch, oligo and polysaccharides (composition of cell wall). Translocation of photosynthates and its importance in sink growth. Mitochondrial respiration, growth and maintenance respiration, cyanide resistant respiration and its significance.

Unit VI

Nitrogen metabolism: Inorganic nitrogen species (N₂, NO₃ and NH₃) and their reduction to amino acids, protein synthesis and nucleic acids. Lipid metabolism- Storage, protective and structural lipids. Biosynthesis of fatty acids, diacyl and triacyl glycerol, fatty acids of storage lipids. Secondary metabolites and their significance in plant defense mechanism. Growth and differentiation.

Unit VII

Hormonal regulation of growth and differentiation, plant growth hormones and their physiological role, synthetic growth regulators, growth retardants, apical dominance, senescence, fruit growth, abscission. Photomorphogenesis: Photoreceptors, phytochrome, cryptochrome. Physiology of flowering: Photoperiodism and vernalization.

Practicals

- Estimation of plant water status: Relative water content, water potential estimation by pressure chamber/ psychrometer
- Growth parameters: Growth parameters measurement
- Photosynthesis and related parameters: Estimation of chlorophyll/ carotenoid content, separation of photosynthetic pigment using paper chromatography, photosynthesis measurements by IRGA, respiration rate measurement.
- Amino Acid and proteins: Estimation of total free amino acids, estimation of proteins by Lowry/ Bradford method.

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K. B. Mishra
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- Nitrogen metabolism: *In vivo* nitrate reductase activity assay, nitrogenase activity assay by gas chromatography.

Course Learning Outcomes (CLO)

Through this course students should successfully:

- distinguish physiological processes involved in the formation of seedlings
- review the factors regulating growth and developmental processes of crop plants
- evaluate strategies used by plants with respect to nutrient uptake and utilization
- Illustrate the significance of assimilate translocation and partitioning.
- Associate crop-environment interaction and crop growth, yield


Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO									
CLO₁	3	-	-	3	3	3	-	3	2
CLO₂	3	-	-	3	3	3	-	3	2
CLO₃	3	-	-	3	3	3	-	3	2
CLO₄	3	-	-	3	3	3	-	3	2
CLO₅	3	-	-	3	3	3	-	3	2
Average	3	-	-	3	3	3	-	3	2

Text books:-

- Salisbury, F.B. and Ross, C.W. 1986. Plant Physiology, CBS Publishers & Distributors, New Delhi.
- Taize, L. and Zeiger, E. 2006. Plant Physiology. Sinauer Associates, Inc, Publishers, Sunderland, Massachusetts, USA.

Reference books:-

Prasad
 Anshul
 K. K. Mishra
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1. Prasad
2. Anshu
3. Kanchan
4. H. Das
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MSS- 205: FIELD PLOT TECHNIQUES

	L	T	P	CR
Course objective:-	2	0	1	3

To inform students about planning and designing of field experiments and analysis of experimental data.

Detail Contents

Unit 1:	10%
Unit 2:	15%
Unit 3:	15%
Unit 4:	15%
Unit 5:	15%
Unit 6:	15%
Unit 7:	15%

Theory

Unit I

Historical aspects, principles and practices of field experimentation

Unit II

Identification of research problem and preparation of research project proposal. Presentation of data and report writing.

Unit III

Planning of experiments, recording of data - before layout of experiment, during crop growth and after harvest. Selection of experimental design, layout of experiment, number of treatments / replications, plot size, border effect etc. Techniques for increasing the precision for an experiment.

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Abhishek
Vishvesh
Pradeep



Unit IV

Interpretation of data from weed control, irrigation, fertilizer and cropping system experiments. Interactions in factorial experiments.

Unit V

Contrast analysis, pooled analysis and data transformation. Evaluation of direct, residual and cumulative effects of treatments.

Unit VI

Correlation and regression analysis, and their application. Energetics and economic analysis.

Unit VII

Analysis of data of typical agronomic experiments. Nutrient and water balance sheets. Statistical softwares and their application.

Practicals

- Practical considerations in field experimentation.
- Analysis of data of field experiments. Use of excel in data analysis.
- Statistical analysis of data using statistical softwares.
- Calculation and interpretation of interaction of factorial experiments.
- Calculation of direct, residual and cumulative effects of treatments in cropping systems.
- Exercise on confounding designs.
- Exercise on contrast analysis.
- Exercise on data transformation. Exercise on missing plot analysis.
- Exercise on pooled analysis of data over years/locations.
- Exercise on linear regression equation.
- Exercise on quadratic regression equation.
- Exercise on computation of energy requirement in agricultural production.
- Economic analysis of field crop production.
- Exercise on determination of optimum economic dose of fertilizers.
- Exercises on interpretation of data from different types of experiments.

Course Learning Outcomes (CLO)

Through this course students should successfully:

- plan and design field experiments
- analyse experimental data of field experiments

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Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	-	1	-	3	1	-	1	1	-
CLO ₂	-	1	-	3	1	-	1	1	-
Average	-	1	-	3	1	-	1	1	-

Text books:-

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. John Wiley and Sons, Singapore.

Rangaswamy, R.A. 2006. Text Book of Agricultural Statistics. New Age International (P) Limited, New Delhi.

Reference books:-






Clewer, A.G. and Scarisbrick, D.H. 2001. Practical Statistics and Experimental Design for Plant and Crop Science. John Wiley and Sons Ltd. West Sussex, England

Cochran, W.G. and Cox, G.M. 1992. Experimental Designs. John Wiley and Sons, Inc. Toronto, New York, USA.

DarmarajuRaghavarao. 1983. Statistical Techniques in Agricultural and Biological Research. Oxford and IBH Publishing Co. New Delhi.

Das, N.R. 2008. Agronomic Research Management. Agrotech Publishing Academy, Udaipur.

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PGS 301 HISTORY OF AGRICULTURE

L T P CR

Course objective:-

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To inform students about history of agriculture and developments in agriculture in pre and post independence era.

Detail Contents

Unit 1: 25%

Unit 2: 25%

Unit 3: 25%

Unit 4: 25%

UNIT-I

Agriculture in ancient India: archaeological findings and literature.

UNIT-II

Ancient literature on: farm implements, forecast of weather and rains, types of lands, manure, irrigation, seed and sowing, pests and their management, horticulture and arboriculture, cattle management etc.

UNIT-III

Agricultural research, education and extension in pre-and post-independent India. Green revolution, success, associated problems, lessons learnt.

UNIT-IV

Challenges to Indian agriculture: future needs and capabilities, environmental problems, international agriculture and partnership. Emerging scenario and expectations.

Course Learning Outcomes (CLO)

Through this course students should successfully:

- describe relevance of agricultural heritage in current times
- review developments in agriculture with time

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Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	2	-	2	2	-	1	-	3	1
CLO ₂	2	-	2	2	-	1	-	3	1
Average	2	-	2	2	-	1	-	3	1





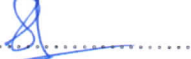
Text books:-

- Saxena, R.C., Choudhary, S.L. and Nene, Y.L. 2009. A Text Book on Ancient History of Indian Agriculture. Asian Agri-History Foundation, Secunderabad, 148 pp.
- Nene, Y.L. (Ed.) 2007. Glimpses of the Agricultural Heritage of India. Asian Agri-History Foundation, Secunderabad, 912 pp

Reference books:-

- Jain, H.K. 2010. The Green Revolution: History, Impact and Future. Studium Press LLC, Houston USA, 276 pp.

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MSS-302: BASIC STATISTICAL METHODS IN AGRICULTURE

Course objective:- To impart knowledge about basic statistics and its applications to research.

L	T	P	CR
2	0	1	3

Detail Contents

Unit 1:	25%
Unit 2:	25%
Unit 3:	25%
Unit 4:	25%

Theory

UNIT I

Classification, tabulation and graphical representation of data. Levels of measurement. Descriptive statistics. Theory of probability. Random variable and mathematical expectation. Probability distributions: Binomial, Poisson, Normal distributions and their applications. Concept of sampling distribution: t, χ^2 and F distributions. Tests of significance based on normal, t, χ^2 and F distributions. Non-parametric tests.

UNIT II

Correlation and regression: Correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, simple and multiple linear regression model. Estimation of parameters. Coefficient of determination. Introduction to multivariate analytical tools: Principal component analysis and cluster analysis.

UNIT III

Planning of an experiment and basic principles of design of experiments. Analysis of variance. Completely randomized design (CRD), Randomized complete block design (RCBD), Latin square design (LSD). Randomization procedure, analysis and interpretation of results. Concept of factorial experiments.

UNIT IV

Planning of sample surveys. Sampling vs complete enumeration, Simple random sampling, Stratified sampling.

Practical

- Exercises on probability distributions.
- Correlation and regression analysis.
- Large sample tests, testing of hypothesis based on χ^2 , t and F.
- Exercises on non-parametric tests.

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Kishore
H. S. S.*



- Principal component analysis and cluster analysis.
- Analysis of data obtained from CRD, RBD, LSD.
- Analysis of data of factorial experiments.
- Selection of a random sample, estimation using simple random sampling.
- Exercises on stratified sampling.

Course learning outcomes (CLO)

Through this course students should successfully:

- Illustrate the basics of statistical theory used in agriculture.
- Compute and apply measures of location and measures of dispersion of data.
- Explain the different hypothesis testing methods.
- Apply the statistical techniques in agricultural experimental designs.

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	-	2	-	3	3	-	2	3	1
CLO ₂	-	2	-	3	3	-	2	3	1
CLO ₃	-	2	-	3	3	-	2	3	1
CLO ₄	-	2	-	3	3	-	2	3	1
Average	-	2	-	3	3	-	2	3	1

Text books:-

Campbell, R.A. 1974. *Statistics for Biologists*. Cambridge University Press.

Gomez, K.A. and Gomez, A.A. 1984. *Statistical Procedures for Agricultural Research*. John Wiley.

Reference books:-

Wiley. Cochran, W.G. 1959. *Sampling Techniques*. John Wiley.

Das, M. N. and Giri, N.C. 1986. *Design and Analysis of Experiments*. New Age International.

Dillon, W.R. and Goldstein, M. 1984. *Multivariate Analysis: Methods and Applications*. John Wiley.

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Jivraj



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MSS-303: LIBRARY AND INFORMATION SERVICES

Course objective:	L	T	P	CR
To teach students the concepts and principles of library and information services	0	0	1	1

Detail Contents

Unit 1: 100%

Unit I:

Practical

- Introduction to library and its services
- Role of libraries in education, research and technology transfer
- Classification systems and organization of library
- Sources of information- Primary Sources, Secondary Sources and Tertiary Sources
- Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.)
- Tracing information from reference sources; Literature survey
- Citation techniques/Preparation of bibliography
- Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services
- Use of Internet including search engines and its resources; e-resources access methods

Course learning outcomes (CLO)

Through this course students should successfully:

- Trace information from libraries efficiently.
- Appraise the information and knowledge resources
- Illustrate on modern tools like internet, OPAC, search engines etc for information searching.

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Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	1	1	1	1	1	1	1	1	1
CLO ₂	1	1	1	1	1	1	1	1	1
CLO ₃	1	1	1	1	1	1	1	1	1
Average	1	1	1	1	1	1	1	1	1

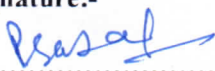
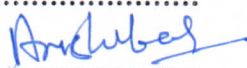


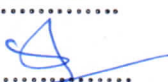
Text books:-

Library and information science. 2004. Pandey D K. Atlantic publishers and dist.

Reference books:-

Basic research methods for librarians. Lynn Silipigni Connaway and Ronald R Powell. 2010. Santa Barbara, Calif. : Libraries Unlimited.

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MSS-400: Credit Seminar

L	T	P	CR
0	0	1	1

Course objective:

Making and delivering presentation by student and holding questions and answering sessions.

Course learning outcomes (CLO)

Through this course students should successfully:

- Test their knowledge by reviewing the literature and question answer session.
- Develop their communication skills

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	2	1	-	1	1	2	-	1	1
CLO ₂	2	1	-	1	1	2	-	1	1
Average	2	1	-	1	1	2	-	1	1

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MSS- 401: Comprehensive Exam and Masters Research Work and Thesis/Project

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Course Objective:

- To evaluate the knowledge gained by student
- To enable the student to gain deeper knowledge, understanding, capabilities and attitudes in the context of the programme of study.

Course learning outcomes (CLO)

Through this course students should be able to:

- apply the theoretical information achieved during the programme
- collect and interpret data
- assess the analytical methods during the programme
- solve problems in soil science and plant nutrition

Mapping of course learning outcomes (CLO) with programme outcomes (PO) and programme specific outcomes (PSO)

PO & PSO \ CLO	PO ₁	PO ₂	PO ₃	PO ₄	PO ₅	PSO ₁	PSO ₂	PSO ₃	PSO ₄
CLO ₁	1	3	-	3	3	1	3	3	3
CLO ₂	1	3	-	3	3	1	3	3	3
CLO ₃	1	3	-	3	3	1	3	3	3
CLO ₄	1	3	-	3	3	1	3	3	3
Average	1	3	-	3	3	1	3	3	3

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Programme Objectives

1. Construct and communicate knowledge to the students about soil related problems with respect to crop production.
2. Teach instrumentation and analytical techniques for analysis of physiochemical and biological properties of soil.
3. Solve problems limiting successful production of crops.
4. Associate knowledge for efficient decision-making, management, sustainable agriculture and soil science.
5. Develop skill in students for successful career in concerned departments, research institutes, industries, consultancy and NGOs, etc.

Program Outcomes

After completion of the program, the students should be able to:

1. Illustrate fundamental knowledge of different aspects of soil science
2. Validate their research skills, including soil testing, conduct of experiments and data analysis.
3. Review the environmental pollution control technologies.
4. Plan, prepare and implement projects related to plants and soil.
5. Develop skills to get job and services in the field of Teaching, Researches, Projects, Municipal Councils/Corporations, National Research Institutes/Organizations/Laboratories, NGO's and other sectors related to the field of soil science.

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PROGRAM SPECIFIC OUTCOMES

After completion of the program, the students should be able to:

1. Illustrate the basic concepts of soil and its components along with their interactions with regard to crop production through study of related courses.
2. Analyze and determine soil physicochemical and biological properties using analytical and statistical techniques to resolve constrains in crop production.
3. Review different technologies from courses from programs like agronomy, crop physiology and statistics etc. to solve problems in soil science to manage soil productivity.
4. Solve problems pertaining to soil science.

Signature:-

1.
Pransav

2.
Arundhata

3.
Harish

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H. D. Das

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