PROSPECTUS

FOR

CERTIFICATE COURSES

UNDER RPCAU, PUSA

Associate Director Education
Certificate Course

DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY
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Proposal of Certificate Courses

Agencies working in the field of agriculture and allied sectors have experienced the lack of skilled manpower for performing low end jobs, these includes academics, research, development department, industry and marketing. This has been a major bottleneck in execution of developmental programs for all the stakeholders of agricultural sector. Several agricultural developmental programmes with investment of millions of rupees in the field of farm mechanization, Hi-tech Horticulture, Tissue culture, Animal breed improvement and in health and hygiene were wasted due to unavailability of lower level skilled manpower. The organizations in the field of academic and development make big investments in the field of rural development but our farmers are not capable enough with their other engagements to utilize the adopted technologies to their full potential and need technically skilled manpower for their support.

Now the Government of India has realized this gap and several programs on skill development has been implemented. Under New Education Policy, the Indian Council of Agricultural Research is also promoting skill development programs through academic institutions. The RPCAU, Pusa being a premier Agricultural University of the central government has taken up this responsibility to initiate this program as "Certificate Courses" of one year duration in its campuses, in order to support the Academia, Research and Development departments in general and the farming community in particular through development of technically skilled manpower in different fields.

On completion of a particular course, the topper students with competence (Required Qualification) and flair for higher education will be admitted in first year of graduation courses in respective colleges, if the college is available in this university. If they want to leave after 1st year due to any reason, they will be awarded diploma. If they complete the full course, they will be exempted from 4th year RAWE and E.L.P and thus, will get degree in 4 years.

Other candidates on successful completion of respective courses will develop into skilled manpower familiar with the theoretical and practical aspects of the course and can provide services to the society in a safe and healthy way so that farming community can achieve maximum output and economy after their engagement as technical support. These men will be self-employed and can work as entrepreneurs, service providers and can assist to academia, research development departments in general and farming community in particular.

A decision was taken in SOC meeting held on 6th Jan 2021 at Sl. No. 3 regarding initiation of certificate courses under RPCAU. Further during 4th Education Council Meeting on 20th April 2021, a presentation was given by the coordinator with proposal for 10 courses-covering details of courses, syllabus with credit hours, selection procedure, method of teaching, fees structure and logistics required. Based on the recommendations of 4th Education Council Meeting, a meeting was convened with all the mentors and stakeholders on 17th May for queries and suggestions reviewing eligibility, fees structure, selection procedure and accommodation etc., in order to initiate these courses from current academic session. After due inclusion of suggestions again a presentation was given in 5th Education Council Meeting held on 21st May 2021 and accordingly this programme has to be initiated with given courses below, with details of the procedures to be observed for certificate course programme in RPCAU.

Courses for current academic session-2022-23 (Summer)

S.No	Course Name	Expert from University	Expert from KVK
1	Farm Mechanization	Dr. Subhas Chandra (Asst.Prof.), FMPE,CAE	Er. Shailesh Kumar, SMS, FMPE, KVK Birauli
2	Senior Citizen Care	Dr.Veena Shahi, Assoc. Prof.HDFS, CCS, Pusa	Dr. Nang Mok Hom Engling, SMS, H. Sc.. KVK, Muzaffarpur (Additional)
3	Nursery Management	Dr. A.K. Singh, Horticulture, PDDUCH&F, Piprakothi	Dr. C. Mukhim, Hort., PDDUCH&F, Piprakothi
4	Plant Tissue Culture	Mentor - Dr. Ram Niwas Singh, (Assoc. Prof.), BRC,Goraul, Kumari Anjani, (Asst.Prof.), CBS&H, Pusa	Dr.Sunita Khuswah, Head,KVK, Vaishali
5	A.I & E.T.T	Dr. Sumit Singhal, Assoc.Prof., RGM, Piprakothi	Dr. Narendra Kumar, Asst. Prof., RGM, Piprakothi
6	Sugarcane Cultivation Assistant	Dr. Navnit Kumar, Assoc. Prof., SRI, Pusa.	Dr. Ajeet Kumar and Dr. Balwant Kumar, SRI, Pusa.
7	Fish Culture Assistant	Dr. Shivendra Kumar, Assoc. Prof., CoF, Dholi	Mrs. Ipsita Biswas, SMS, KVK, Muraul
8	Seed Production Assistant	Dr. Rajesh Kumar, Assoc. Prof., DSF, Dholi	Dr. Ravikant, DSF, Dholi.

Normally each courses will have 3 types of students pursuing courses called Foundation for (8^{th} Class pass students), Basic (10^{th} Class pass students), and Advanced (12^{th} Class pass students). All courses will be of two semesters. Each semester will generally be of 110 days duration. Every enrolled student will berequired to take a specified load of course work in the semester. The details of these courses are in below table;

Courses & Credit hours of certificate courses

Ist Semester		
Course/Students	**Basic Degree**	**Credit Hrs**
Foundation	8^{th}	20
Basic	10^{th}	24 (20+4)
Advance	12^{th}	28 (24+4)

IInd Semester (Village / Laboratory Attachment)		
Course/Students	**Credit Hrs**	**Evaluation Pattern**
Class Participation and PRA assignments	(0+14)	20 marks (KVKs)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK + 10 marks Attached Unit)
Attendance/ Lab Records		10 marks
Practical Exam (Evaluation Pattern at page - 5)		50 marks

A	Foundation	Gap assessment in management at village level through PRA and assistance.
B	Basic	Foundation + Problems in adoption and options to overcome under different social groups.
C	Advanced	Basic + 1. Dynamics of: Input – Yield – Economics 2. Laws regarding the activities, if any

Grading System

a) The grading system will be on a 10 point scale.
b) The pass marks of a subject will be 50% (5.0 on 10 point scale).
c) A student graduating from this university must have an overall 55% marks (5.5 on 10 points scale).
d) A student will have to reappear in the subsequent examination of the subject if he/she fails after getting himself/ herself registered in that course.

Duration of the Programme

i. Minimum 2 semesters (1 academic year)
ii. Maximum 4 semesters
iii. It is mandatory to complete the entire courses and project work to qualify for the certificate of the Programme..

Evaluation:

The distribution of marks in internal examination will be as follow:

S.No.	**Type of Examination**	**Course involving practical***	**Course involving no Practical**	**Course involving only practical ***	
				Type of examination	**Total Marks**
1	Mid Term exam.	30	40	Written+Practical	10+20
2	End Term Exam	50	60	Written+Practical	15+25
3	Practical Exam	10	-	Final Practical	10
4	Maintenance of Practical Record	**10**	**-**	Maintenance of Practical Record	10
5	-	-	-	Viva-voce	10
Total Pass Marks		**50**	**50**		**50**

Note*: Mid-term and final examination may also include theoretical questions based on practical.

Selection Procedure:

A. Advertisement will be circulated through university website and also in news paper for starting the certificate courses giving name of the courses, examination fees and no. of seats to each course. The details of selection procedure will be given on website with form regarding no. of seats under different categories, Age limit and age relaxation, Fees structure to different courses besides other relevant information and instructions.

B. Intake to courses will be through common written competitive examination followed by viva.

C. Questions will be from:

1. Reasoning -	(30 Marks)
2. General Knowledge-	(20 Marks)
3. General Science -	(40 Marks)
4. Viva	-(10 Marks)
Total – 100 Marks	

D. Candidates merit list will be prepared separately for 8^{th}, 10^{th} and 12^{th} class pass categories as per given choice of courses, following Govt. of India Reservation policy.

E. Application Fees (Online Submission & Offline Exam)
Gen/ OBC/EWS – Rs 500/-course and for SC/ST –Rs 250/-course.

F. Eligibility and Age Limit under different courses for different categories of students-
Age as on 31 july 2022 will be taken for eligibility as detailed below..

S.No	Course Name	8th Pass	10th Pass	12th Pass
1	Farm Mechanization	16-20	18-22	18-22
2	Senior Citizen Care *	16-20	18-22	18-22
3	Nursery Management	16-20	18-22	18-22
4	Plant Tissue Culture	-	18-22	18-22
5	A.I & E.T.T	-	-	18-22
6	Sugarcane Cultivation Assistant**	16-20	18-22	18-22
7	Fish Culture Assistant	16-20	18-22	18-22
8	Seed Production Assistant	16-20	18-22	18-22

*In Senior Citizen Care course, the age limit for female candidates will be 16-35 Years for 8^{th} pass and 18-35Years for 10^{th}& 12^{th} pass applicants.

**** In Sugarcane Cultivation Assistant Course only male candidates will be considered**.

G. Age Relaxation will be given as per government norms – 5 Yrs for SC/ST and 3 Years for OBC.

H. Government of India reservation Policy as below will be followed during admissions.

Category	% of Reservation
OBC (NCL- Non Creamy Layer, whose family annual income is less than Rs.6 lakh)	27%
SC	15%
ST	7.5%
EWS	10%
Selection of Pwd candidate as per GOI Policy	

I. In senior citizen Care course 66% of seats will be reserved for female candidates.

J. Under each course the no. of seats will be 20 seats each and the average intake for 8th will be 7/20, 10th – 7/20, and 12th – 6/20 but at S.no 4 it will be 10/20 for 10th and 10/20 for 12th. At S.no 5 course all the seats will be for 12th pass. University reserves the right to increase the no. of seats in the courses in fraction or in total 25% as per approval.

Fees Structure:

S.No	Course Name	Admission fee/ Sem. (Rs)			Tuition fee / Sem. (Rs)			Accommodation Charge / Sem. (Rs)	Total / Sem. (Rs)		
		8th Pass	10th Pass	12th Pass	8th Pass	10th Pass	12th Pass		8th Pass	10th Pass	12th Pass
1	Farm Mechanization	7500	11250	15000	3750	7500	7500	2000	13250	20750	24500
2	Senior Citizen Care	5000	7500	10000	2500	5000	5000	2000	9500	14500	17000
3	Nursery Management	5000	7500	10000	2500	5000	5000	2000	9500	14500	17000
4	Plant Tissue Culture	-	7500	10000	-	5000	5000	2000	-	14500	17000
5	A.I & E.T.T	-	-	20000	-	-	10000	2000	-	-	32000
6	Sugarcane Cultivation Assistant	5000	7500	10000	2500	5000	5000	2000	9500	14500	17000
7	Fish Culture Assistant	7500	11250	15000	3750	7500	7500	2000	13250	20750	24500
8	Seed Production Assistant	7500	11250	15000	3750	7500	7500	2000	13250	20750	24500

K. Probable location for the conduct of courses:

S.No	Course Name	Associated with the units	Probable places for course work*
1	Farm Mechanization	KVK, Birauli, Samastipur	KVK, Birauli, CAE, Pusa & Anywhere Field Work.
2	Senior Citizen Care	KVK, Muraul, Muzaffarpur	KVK, Muraul, CCS, Pusa & Anywhere Field Work.
3	Nursery Management	KVK, Piprakothi, East Champaran	KVK, Piprakothi, PDDUCH&F & Anywhere Field Work
4	Plant Tissue Culture	BRC, Goraul, Vaishali	Pusa, Goraul & Anywhere Field Work

5	A.I & E.T.T	RGM, Piprakothi, East Champaran	RGM, East Champaran & Anywhere Field Work.
6	Sugarcane Cultivation Assistant	SRI, Pusa/ Kalyanpur	SRI, Pusa/ Kalyanpur & Anywhere Field Work.
7	Fish Culture Assistant / मत्स्य कल्चर सहायक	College of Fisheries, Dholi / मत्स्य कॉलेज, ढ़ोली।	College of Fisheries, Dholi and Anywhere Field Work/ मत्स्य कॉलेज, ढ़ोली और कहीं भी फील्ड वर्क।
8	Seed Production Assistant/ बीज उत्पादन सहायक	DSF campus, Dholi/ डी.एस.एफ. कैम्पस, ढ़ोली।	DSF campus, Dholi and Anywhere Field Work/ डी.एस.एफ. कैम्पस, ढ़ोली और कहीं भी फील्ड वर्क।

*****Accommodation: Dormitory with cot will be provided to each candidate joining the courses on above probable locations. Food and other logistics will be arranged by the candidates on self payment basis and the local unit will help for the same.

L. Infrastructure and Equipments for the certificate courses

- The existing infrastructure available at the units will be utilized at respective places where courses has been assigned, any change as per need may be requested to the Competent Authority for better conduct of the courses, subjected to approval.
- Only critical inputs may be given for conducting these courses as per availability of fund on requisition. These will be compiled at coordinator level and will be put up through constituted committee for further needful consisting of :
    1. Dean, CAE
    2. Director, SRI
    3. ADE (Certificate Course)

M. <u>Three committees will look after Advertisement, Examination and Admissions separately with details of work to be accomplished..</u>

- **Advertisement committee:** Preparation of Application form, Examination fee, Roster finalization, Advertisement, Screening of applications and issue of admit card.
- **Examination committee:** Preparation of question paper& Printing, Approval of Admit card, conducting examination, Evaluation and Result Preparation as per norms.
- **Admission committee:** Issue of letter for admission to candidates above cut off marks, Documents verification, Collection of fee as per structure, filling of vacant seats from waiting list and issue letter to candidates to join courses at KVKs.

The details of courses has been annexed as annexure 1 to 8.

CERTIFICATE COURSE FOR KVK ON

"FARM MECHANIZATION"

Syllabus

Dr. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY,
PUSA (SAMASTIPUR) BIHAR

INTRODUCTION

Mechanization in agriculture is a crucial input for agricultural crop production. Factors that reduce the availability of farm power compromise the ability to cultivate sufficient land. Increasing the more power supply to agriculture means that more tasks can be completed at the right time and greater areas can be farmed to produce greater yields of crops while conserving natural resources. The increasing level of mechanization has tremendously changed the scenario of agriculture and also the development and establishment of farm machinery manufacturing industries in the state in particular, and in the country in general. Obviously, this phase is warranting the demand of skilled hands in farm machinery manufacturing, maintenance and operations.

The person trained in farm mechanization must deal with the maintenance and repair of tractor, power tiller and other farm implements. In addition, trained person may test farm machine system and troubleshoot problems, when occurs. In this endeavour, farm machinery mechanics may use computer-aided systems to help troubleshoot and even repair the faulty part or parts. This position might include tasks ranging from working on an engine's electrical system or carburettor to welding cracked pipefitting.

Moderately educated youth of the society can be trained and become skilled farm machinery handler for repair and maintenance. This course focuses on providing hands-on capacity building of the students for learning the basics of farm machinery and its service and maintenance. The candidates completing this course can be employed as farm machinery assistant, technician, operator and supervisor in farms, research institutes and industries. They will also become competent asservice provider, establishing their own farm machinery service centre or assist in repairing and maintenance of farm machinery.

The **Major Objectives** of the programme will be:

a) To create skilled human resource in villages and towns to support agricultural mechanization led programmes of public and private sectors.

b) Enabling rural youths for providing services, establishing mini-workshops in rural areas to render services for repair and maintenance of farm machines/implements.

c) To create employment opportunity for youth in the field of machinery operation, repair and maintenance.

The candidates completing this course will have job opportunities in following areas:

The area of work of farm mechanic may be in fabrication, production as well as in service sectors, besides growing as entrepreneurs. The important area of job opportunities of farm mechanic will be in terms of

i. Wage employment

(a) Assistant mechanic and fitter in farm machinery workshop.
(b) Agricultural machinery service mechanic.
(c) Agricultural machinery sales person.
(d) Agricultural machinery operator.
(e) Spare parts sales assistant.

ii. Self employment

(a) Agricultural machinery mechanic.
(b) Spare parts salesman.
(c) Entrepreneurship in custom hiring services.
(d) Establishing mini-workshop in rural area.

COURSE STRUCTURE

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table 1).

Table 1: Qualification category wise credit load

S. No.	Course	Eligibility	Credit Hrs		
			Semester I	Semester II	Total
1.	Foundation	8th pass	20 (8+12)	28 (0+28)	48
2.	Basic	10th pass	24 (10+14)	28 (0+28)	52
3.	Advanced	12th pass	28 (13+15)	28 (0+28)	56

The candidates will be offered courses in the first semester to provide them knowledge of the basic understanding of the course. The list of courses offered under different programmes is given in Table 2.

Table2. List of courses offered

The first semester will consist of theory and practical works as per the credit hours as follows:

SEMESTER-I

Foundation courses
Total credit hrs: 20 (8+12)

Course No.	Course Code	Course Title	Credit Hrs
1.	FMA 101	Workshop technology and Operation of Tractor,	1+3
2.	FMA 102	Selection, operation, repair and maintenance of tillage machineries and soil forming equipment	1+2
3.	FMA 103	Selection, operation, repair and maintenance of seeding and planting equipment	1+2
4.	FMA 104	Selection, operation, repair and maintenance of intercultural and plant protection equipment	1+1
5.	FMA 105	Selection, operation, repair and maintenance of harvesting and post harvesting machineries	2+2
6.	FMA 106	Operation, repair and maintenance of power tiller and special agricultural machineries.	1+2
7.	FMA 107	Cost estimation and custom hiring rates for agricultural machineries	1+0

Basic courses [Foundation courses (20) + additional courses (4)]
Total credit hrs: 24 (12+12)

8.	FMA 201	Bottlenecks in farm mechanization. Identification of machines based on crop production techniques.	2+0
9.	FMA 202	Care & maintenance of equipment inventory.	2+0

Advanced [Basic (24) + additional courses (4)]
Total credit hrs: 28 (13+15)

10.	FMA301	Identification of hazard locations in machine. Standard safety procedures.	1+1
11.	FMA 302	Laws for movement of heavy and oblong machines on transport road, standard procedure for setting up workshop and CHC.Book keeping & estimation of economics of use.	2+0

SEMESTER-II

The second semester will consist of Village /Laboratory attachment where the candidates will be given exposure to the commercial establishments/Farmers covering following parameters:

Course/Students	Credit Hrs	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK, 10 marks Attached Unit)
Attendance		10 marks
Practical Exam		50 marks

***The assignments will cover the following aspects for each course:**

A. **Foundation** : Gap assessment in management at village level through PRA and stepwise assistance required.

B. **Basic** : Foundation + Problems in adoption and options to overcome under different socio-economic groups.

C. **Advanced** : Basic +1. Dynamics of: Input – Yield – Economics
2. Laws regarding the activities, if any

DETAILED SYLLABUS

SEMESTER-I

Course No. 1: Workshop technology and operation of tractor: FMA 101 (1+3)

Theory: Familiarization with general safety Measures, Identification of different files and practicing filing operations, Marking out for drilling, Grinding chisels, Identify various parts of lathe, learning the operation and centring on lathe, Identify hand tool for sheet metal worker, Identify gas and arc welding machines, Identify common agricultural machinery tractor, learning its general features for attending common functional problems, Establishing a mini-workshop for repair and maintenance of farm machines/implements, Finance support/scheme of Central/State Govt.

Practical: Identification of hand tools and practice tools, Learn measuring techniques using various measuring, Instruments, Lathe operation and centring on lathe, Practice plain turning, step turning, screw turning, boring and Knurling, Practising simple exercises on forging, heat treatment, hardening, annealing etc., Practice simple exercise on welding, Identify and practice shop power tools and equipments such as air compressor, hoist hydraulic/mechanical jack, jack stand, support, lift/cranes, hydraulic press etc., practice of tractor driving.

Course No. 2:Selection, operation, repair and maintenance of tillage machineries and soil forming equipment: FMA 102(1+2)

Theory: Function and component identification of the tillage machineries such as mouldboard plough, disc plough, disc harrow, cultivator, rotavator, rotary tiller and soil forming equipment like leveller, scraper, scaper/blade terrace, ditcher and bund formers, Repair and maintenance needs of a mouldboard plough, disc plough, disc harrow and cultivator, leveller, scraper, scaper/blade terrace, ditcher and bund formers, Importance of carrying out regular service and maintenance of the tillage machinery and soil forming equipment, Adjustment of gauge wheels, disc tilt angle and the working depth of tillage machinery.

Practical: Operation of tillage machineries and soil forming equipment, Application of recommended grade of lubricant on mouldboard plough, bearings, bearing housing, bearing assembly, mating parts, coulter hub and all greasing points, Show how to sharpen the bar point, harrow discs and shares, Correct attachment of tillage machineries and soil forming equipment with tractor, Installation of new parts to replace the worn-out or damaged parts, Analyse all the nuts, bolts, bearings and castle nuts for locking and recommended torque, Demonstration of necessary adjustment to the horizontal disc angle, vertical tilt angle, the width of cut, level of plough, setting of levelling board, scrapper position as per the service manual, Evaluate the performance of the depth control system, Evaluate the disc spacing and diameter is as prescribed, Carry out welding on the broken joints and installation of new discs, shovel points, disc plough hub seal, grease nipple, spool flanges, gang-bolts, gang bearings, pins, nuts and bolts to replace the ones worn out or damaged.

Course No.3: Selection, operation, repair and maintenance of seeding and planting equipment: FMA 103 (1+2)

Theory: Study of seed drill, zero-till seed cum fertilizer drill, Happy seeder, Super seeder, Drum seeder, Paddy-wheat seeder, manual paddy transplanter, self-propelled paddy transplanter, multi crop planter, potato planter, different sugarcane planters, vegetable planter etc., Identification of various components of the seed and fertilizer box and tubes, power transmission system, seed and fertilizer metering and application equipment, Needs of common repair and maintenance of the seed and fertilizer box and tubes, power transmission system, seed and fertilizer metering and application equipment, Use of various attachments used with seed drills and planters, Relevant adjustments required to be made to the seed drill and planters for their optimum performance, Discuss seed rate of main crops, Calibration needs of seed and fertilizer metering.

Practical: Field operation of seeding and transplanting equipment, Demonstration to clean the metering roller, seed and fertilizerboxes, seed and fertilizer application equipment and check drive,feed shafts and rotary tiller for unrestricted movement, Examine all sprockets for firm connection with their shafts, Demonstration to apply necessary adjustments to align sprocketsof drive wheel with feed shafts, chain and idler sprocket, Application of grease/ lubricant on seed/ fertilizer boxes, meteringrollers, drive, feed shafts, rotary tiller, fertilizer and seed application equipment, Installation of a new axle of wheel to replace the bent or damaged one, Check the drive belt for the required level of tension, Inspect the bed shaper for the correct position and adjustment ofdepth control wheel for seed placement at correct depth, Calibration for seed and fertilizer application rate to the recommended settings, Analyse all the nuts and bolts in the seed and fertilizer meteringand application systems for the prescribed level of torque and locking, Inspect the seed/ fertilizer tubes for bends/ wear and tear/ damage, Demonstrate the process of installing new seed/ fertilizer tubes toreplace the worn-out or damaged ones, Demonstratesetting the seed/ fertilizer tubes with seed/fertilizer cups firmly.

Course No. 4: Selection, operation, repair and maintenance of intercultural and plant protection equipment: FMA 104(1+1)

Theory: Safe handling of various chemicals used in plant protection, Working principle and Identification of the components of fertilizer applicator, different sprayers like knapsack sprayer, boom sprayer, orchard sprayer, electrostatic sprayer, aeroblast sprayer, mist blower and duster along with different types of nozzles, Repair and maintenance needs of different types of plant protection equipment, Process of detecting defects and making adjustments to various components of the sprayer and duster, Calibration of the plant protection equipment, Study of Power weeder, Process of giving first-aid and treatment for chemical poisoning.

Practical: Operation of plant protection equipment, Demonstration of cleaning of tank, strainers and delivery hoses using clean water and the process of setting the nozzle correctly after cleaning, Inspect the delivery hose joints, pump assembly, plunger rod, piston parts, gaskets, piston rings, by-pass and cut-off valve and washers for wear and tear or damage, Analyse all the nuts and bolts are secured tightly, Application of grease/ lubricant on plunger rod and piston parts, Show ways to optimally utilise material/ water/ electricity/ energy in different tasks/ activities/ processes, Connection of electrical tools and equipment safely, Field operation of

power weeder, Dismantle and Assemble of plant protection equipment.

Course No. 5: Selection, operation, repair and maintenance of harvesting and post harvesting machineries: FMA 105(2+2)

Theory: Importance of carrying out regular maintenance and repair of harvesting and post-harvesting machineries, Working functions and component identification of the various components of reapers, maize sheller, combine harvester and power threshers such as cutter bar, reel/ star wheel, windrower, etc., Identify various attachments used with postharvest equipment, Explanation of relevant adjustments to be made to operate post-harvest machineries, Explanation of the common defects found in reapers, threshers and post-harvest machineries, Explain the service and maintenance procedures for harvesting and postharvest machineries, List various tools and equipment used in the repair and maintenance of the harvesting and post-harvesting machineries, Describe the process to replace components in different types of reapers, threshers and post-harvest machineries.

Practical: Operation of harvesting and post harvesting machineries, Examine crop-row divider and cutter bar for any wear and tear or damage, Check the reel belt, thresher belt and v-belt forthe required level of tension, Inspect the drive pulley key and the belt for a secure connection, Check all the nuts, bolts and reaper components are secured firmly, Examine the conveyor belt, v-belt, cutter bar, knife, star wheels, pressure springs and lugs for wear and tear or damages, Demonstrate the process of cleaning the reaper guards and thresher, Application of paint on the machine body and lubricant on the greasing points, Demonstrate how to adjust the blades and height of the reel to ensure the optimum cut length and correct gathering of crop respectively, Show how to set the twine tension along with the tension in trigger spring to get the required bundle size, Evaluation of the performance of the feeding mechanism, Examine the sieve and concave setting, Adjustment the base angle of feeding chute, concave gap and clearance, and the reel height and idler pulley as per the operator's manual, Show how to set the cylinder concave clearance and sieve slope as per the operator’s manual, Demonstrate the process of setting the recommended speed of blower/aspirator, sieves, and threshing cylinder, Demonstrate the process of setting the recommended speed of blower/aspirator, sieves, and threshing cylinder, Show how to clean the post-harvest machineries such as cleaner/grader, drying equipment, rice/ flour/ spice mill, oil expelling machines, chaff cutters etc, Check the sieves and hoppers for correct oscillation and any wear and tear/ damage, Inspect the components of mills and oil expelling machines, feeding chute, blade and gear for correct functioning, wear, tearand damage.

Course No. 6: Operation, repair and maintenance of power tiller and special agricultural Machineries: FMA 106 (1+2)

Theory: Function and advantage of using power tillers, Repair and maintenance need of power Tiller, Benefits of tilling in pattern, Different types of power tiller attachment and their use, Trouble shooting of power tiller, Identify various tools, equipment and spare parts required for the repair and maintenance of a power tiller, Functions and working principles of special agricultural machineries such as laser leveller, trencher 7 dozer/dumper and posthole digger, Component identification and repair and maintenance of special agricultural machineries.

Practical: Operation of power tiller, Correct process of hitching and unhitching of attachment, Process of carrying out repair and maintenance of a power tiller by making necessary adjustments to it, Operation of special agricultural machineries settingand adjustment of agricultural machineries, Assemble and dismantle of power tiller Engine.

Course No. 7: Cost estimation and custom hiring rates for agricultural machineries FMA-107(1+0)

Theory: Repairing cost estimation, Cost of use, Machine hiring charge, Fixation of custom hiring rates.

Practical: NIL

Course No. 8: Bottlenecks in farm mechanization. Identification of machines based on cropproduction techniques. FMA 201 (2+0)

Theory: Introduction to socio-economic and infrastructural shortcomings in the farm mechanization. Identification of equipments based on holding size and crop production techniques.

Practical: Nil

Course No. 9: Care & maintenance of equipment inventory. FMA 202 (2+0)

Theory: Farm operation based inventory preparation of farm implements. Shed orientation and parking of regular as well as seasonal equipments. Farm implements routine scheduling, periodic care and maintenance.

Practical: Nil

Course No. 10: Identification of hazard locations in machine and standard safety procedures. FMA -301 (1+1)

Theory: Sources of accident, mishap and identification of hazard locations. First aid facilities atwork place. Chemical substance handling.

Practical: Preparation of first aid box and first aid procedure.

Course No. 11: Laws for movement of heavy and oblong machines on transport road, standard procedure. Book keeping & estimation of economics. FMA 302 (2+0)

Theory: Study on laws& rules prescribed for machine movement and setting up workshop facilities. Estimation of economics of machine use for setting up CHC and book keeping.

Practical: Nil

SEMESTER II

1. **Foundation Course: Gap assessment in management at village level through PRA & assistance:**

   The candidates are required to identify the gap in adoption of mechanized farming at their village/farm. The assessment of gap between prevailing farming practices and proposed mechanization will be achieved by a survey to gather information through a questionnaire based on PRA.

The major aspects of this survey are as follows:

- Implement resource map of village.
- Listing of crops preference in different season.
- Listing of crop production techniques for each crops.
- Prevailing availability/use of machinery and repair facilities.
- Information status among farmers regarding machines & tools for each farm operation.

2. **Basic Course: Foundation course + problems in adoption & options to overcome under different socio-groups.**

The candidates pursuing basic course will be required to identify the problems and suggestions for possible solution based on aspects addressed by the foundation course assessment questionnaire. They will be required to achieve the following aspects:

- Factor affecting accessibility and rejection of available machines
- Identification of machines on the basis of crop preferences and socio-economy groups of targeted units.
- Plan to filled shortcoming gaps

3. **Advance Course**: **Basic course + dynamics of input, yield, economics and laws of activities.**

The candidates pursuing advance course will addressed the following aspects:

- Estimation of economics of farm machine identified by the basic course candidates.
- Evaluation of possibilities for custom hiring of machines on individual as well as group entrepreneurship basis.
- Identification of skill-set required for machine operators and mechanics.
- Enlisting rules and regulations for setting up CHC and workshop.
- Enlisting rules for movement of heavy & oblong machines on transport road.

4. **Practical skills acquired with their step wise assessment :**

The candidates will be assessed for practical skills acquired as per job responsibilities assign to them areas follows:

Sl. No.	Courses	Job responsibility
1.	Foundation	Recording and presentation of PRA based information, Acclimatization of gaps pertaining to farm mechanization.
2.	Basic	Recording and presentation of PRA based information, acclimatization of gaps pertaining to farm mechanization, Analysis of information gathered through questionnaire, Formulation to fill the mechanization gaps.
3.	Advance	Recording and presentation of PRA based information, acclimatization of gaps pertaining to farm mechanization, Analysis of information gathered through questionnaire, Formulation to fill the mechanization gap, Formulation of plan for accessibility of farm machine to target units.

List of Infrastructure Required

Sl. No.	Particular	Specification/quantity
1.	Training hall with one classroom	Training hall: 25 m x 12 m Class Room : 5 m x 4 m
2.	Workshop and farm machinery sheds	01 each
3.	Furniture	For 20 students
4.	Classroom and hostel for accommodation of 40 candidates	01 each
5.	Washing room	01
6.	Vehicle	01

List of Farm Machinery &Equipments Required

Sl. No.	Particular	Specification/ quantity
1.	Tractor- 55hp, Power tiller	As per specification
	Reversible Mouldboard plough-1, Disc plough-1, Disc harrow-1, Cultivator-1, Rotavator-1, chisel plough-1, subsoiler-1, offset Disc harrow-1, bund maker-1, Tractor operated angle blade tracer-1, tractor operated scraper and bucket scraper-1, Ditcher-1, Trencher-1, Leveller-1, Laser land leveller-1	
	Seed cum fertilizer drill-1, Zero till seed cum fertilizer drill-1, Happy seeder-1, Super seeder, Manual paddy transplanter-1, self- propelled paddy tranplanter-1, multicrop planter-1, Raised bed planter-1, Drum seeder-1, Paddy-wheat seeder-1, Vegetable transplanter-1, metering Systems for seed & Fertilizers, furrow openers, sugarce transplanter-1, Bud chip cutting machine-1, Potato planter-1	
	Knapsack sprayer (manual/battery operated)-1, mist blower-1, boom sprayer-1, electrostatic sprayer-1, Aeroblast sprayer-1, power Weeder-1, Twin wheel hoe-20, Paddy weeder, Mulcher-1, Grass cutter	
	Vertical conveyor reaper-1, Power trsher-1, Multi crop thresher-1, Reaper binder-1, straw reaper-1, combine harvester-1, potato digger-1. Maize sheller-1, Ground nut digger-1, cleaners/ graders-1, Sugarcane crushers-1, manual chaff cutter-1, Power chaff cutter-1, Drying equipment-1, Dal mill-1, Rice mill-1, Flour mill-1.	

List of Tools & Workshop Equipments Required

Sl. No.	Particular	Specification/ quantity
1.	Tools such as screwdriver set, pliers set, hammer set, set of chisels, set of files, hand hacksaw, set of spanners, set of sockets, set of pullers, pipe wrench, adjustable screw wrench, chisel set, tongs, hand grease gun, bench vice, micrometer, vernier callipers, screw jack, hydraulic jack, air compressor, washing machine, welding machine, bearing pullers, anvil, cotton jute etc Power cutter, Drill machine, Lathe machine, MIG welding, sheet cutter, Rolling machine and Power Press	As per requirement.

List of Class & Safety Aids Required

Particulars	Items	Quantity
Class Aids	Whiteboard	02
	Marker	As per requirement
	Projector	01
	laptop	01
	Air conditioner (1.5 ton)	As per requirement
Safety Aids	Personal protective equipment, first aid kit, equipment used in medical emergencies.	As per requirement

List of Manpower, Consumable and Miscellaneous

Sl. No.	Particular	Quantity
1.	Mechanic, helper, tractor driver	02 each
2.	POL	As per requirement
3.	Consumable item	Rs 1.0 lakh/batch
4.	Contingency and miscellaneous including TA/DA of resource persons	Rs 2.0 lakh/batch

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CERTIFICATE COURSE FOR KVK

"SENIOR CITIZEN CARE"

SYLLABUS

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INTRODUCTION

In Indian society, elderly people are regarded as symbol of the divine and are respected. Ageing has been viewed differently by different persons. Traditionally elderly were highly honored and had full authority in the family or community and had decision making responsibilities in the economic and political activities of the family, slowly and gradually, the transition of Indian society from the traditional pre-industrial to industrial has led to the emergence of nuclear families, rapid erosion of social values and occupational pressure of urban society. The joint family system, which used to provide a form of social security, is disintegrating now. Even in the villages where approximately three- fourths of India population lives, where the process of change has been slow but changes are unfavorable to the elderly, it is fortunate that this problem has not assumed serious proportions; nonetheless it requires attention. Approximately 6-7 percent of the Indian population needs assistance for their day to day requirements.

At the family level, the onus of looking after the needs of parents lies on the younger generation. Traditionally this task rests on women being the spouse, daughter or daughter-in-laws. Women are the main source of emotional support and first to look after the elderly while sons are distant in care giving role. Changes in families and consequent change in role of women with paid work outside home has led to the development of a feeling of self-contends, individualism and youngsters being concerned only about themselves. It has also affected the nitty-gritty of the family system in the sense that cohesiveness among family members has loosened as caring, sharing and concern for one another. These changes have adversely affected the status of elderly with urbanization as families are becoming nuclear, smaller and are not always capable of caring for older inmates.

The most ageing implies physiological and psycho-social changes reflected in general physical weakness, decline in sense perception and mental activities. Also lessening in social activities and interest. The characteristics of old age include poor mental and physical health, low social-economic status, possibly isolated living conditions, more and longer hospital stays and more money spent on health and drugs. These conditions need special skills for caring Geriatric population.

Objective of the programme:

1. To provide theoretical and practical knowledge on geriatric care including needs, nutrition and psychology.
2. To provide theoretical and practical knowledge on Geriatric diseases.
3. To develop practical and skilled manpower caring for old age population.

COURSE STRUCTURE

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table 1).

Table 1: Qualification category wise credit load

S. No.	Course/student	Eligibility	Credit Hours		
			Semester I	Semester II	Total
1.	Foundation	8th pass	20	28	48
2.	Basic	10th pass	24(20+4)	28	52
3.	Advanced	12th pass	28(24+4)	28	56

Theoretical and practical knowledge will be offered to the candidates in the first semester to provide them the basic understanding of the course. The list of courses offered under different programmes is given in table 2.

SEMESTER-I

Table 2. List of courses offered

Foundation courses - Total credit hrs: 20 (09+ 11)

Course No.	Course Code	Course Title	Credit Hrs.
1.	SCA 101	Introduction, aim, scope of Geriatric course	2 (2 + 0)
2.	SCA 102	Health and personal Hygiene	4 (2 + 2)
3.	SCA 103	Geriatric Nutrition& Food Preservation	3 (1+ 2)
4.	SCA 104	Skills on kitchen hygiene and housekeeping maintenance	3 (1 + 2)
5.	SCA 105	Environment & Seasonal effect in different region	2 (1 + 1)
6.	SCA 106	Psychological Care & Counselling	2 (1 +1)
7.	SCA 107	Basic Computer Skills	2 (0 + 2)
8.	SCA 108	Institutional Management	2 (1 + 1)

Basic courses [Foundation courses (20) + extra courses (4)]
Total credit hours: 24(12+12)

9.	SCA 201	**Geriatric diseases& Management**	2(1 + 1)
10.	SCA 202	**Old age population policies and Act.**	2 (2+ 0)

Advanced [Basic (24) + extra courses (4)]

Total credit hours: 28 (14+14)

11.	SCA 301	**Anatomy, physiology and human development.**	2 (1 + 1)
12.	SCA 302	**Types of Developmental challenges.**	2 (1+ 1)

SEMESTER-II

The second semester will consist of Village /Institutional attachment where the candidates will be given exposure to the commercial establishments, NGO's, hospitals, nursing home, old age homeetc. covering the following parameters:

Course/Students	Credit Hrs.	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK, 10 marks attached unit)
Attendance		10 marks
Practical Exam		50 marks

Total- 28 100 marks

The assignments will cover the following aspects for each course:

A. Foundation : Problems Identification at village level through PRA and stepwise assistance.

B. Basic : Foundation + solution to overcome the old age problems under different socio-economic groups.

C. Advanced : 1. A + B + Project plan based on different geriatric issues
2. Laws regarding the activities, if any

Foundation Courses DETAILED SYLLABUS

SEMESTER I

I. Introduction, aim, scope of Geriatric course. (SCA 101) 2 (2 + 0)

Theory:

Gerontology (Science of ageing) as a discipline, Definition, , need and importance, the Life-course perspective on aging, Multiple-domains and definitions of aging, key concepts and theories in the study of aging, Biological Theories of Aging, Specific problems for female Specific problems, for male & their care, different types of common problem face by aged person; bed sore, walking issues, talking issues etc, Importance of understanding difficulties and needs of disabled persons, career opportunities in Old Age Care, necessity of an old age Home & Care for old age who have none to look after or one who wishes to enjoy isolated life, different type of homes for old age person.

Practical:

Nil

II. Health and personal Hygiene. (SCA 102) 4 (2 + 2)

Theory:

Fundamental of Health & Hygiene: definition of physical, mental health and mental illness, listing out different common and specific physical/mental diseases & health issues related to age and gender; its classification and function, Physiological Changes during old age, Principle related to maintenance of normal circulation and normal respiration, Definition of hygiene and its importance, Personal hygiene, oral diseases and dental hygiene, Infectious and non-infectious diseases; remedies and difficulties for Male: Prostate, Kidney stone, gland infection etc, remedies and difficulties for Female: urinary tract Infection, fungal infection etc, Positive & negative factors affecting health & healthy living, Knowledge of general occupational safety.

Practical:

Identify different physical and mental health related issues for old age persons and comply the methods for solutions after 50 years. Demonstrate specific physical health issues like asthma, knee pain, back pain, bed sore, piles etc. Demonstrate condition of different mental health issues of aged person; memory loss, insomnia, depression etc, Importance of exercise, rest, sleep and good grooming .Group discussion and practice with demonstration on importance of personal hygiene, Motivating individual on personal hygiene & recognizing the positive & negative trends in the community, Giving first Aid for burns, cuts etc. importance of yoga in physical health of aged person,

III. Geriatric Nutrition & food preservation (SCA 103) 3(1+2)

Theory:

Introduction, various nutrients and its sources and deficiency disorders, Different types of food of importance to geriatric, Nutritive value of different foods, Importance of preservation, different technique for preservation of food, common preservative for food and effects of preservative on food, principle and technique for refrigeration, Balanced diet - definition, concept, importance, Various therapeutic nutrition for old age health problems ;importance and need, Dietary changes with age, dietary requirement, Diet plans for elderly, Myths about diet.

Practical:

Preparation of dietary chart for diabetic, blood pressure and digestive disorder etc, Preparing dietary chart as per requirement of old aged person like high protein, high fiber high sugar etc. Preparation of therapeutic diet for different health issues during old age, Preparation & Preservation of food,.

IV. Skills on kitchen hygiene and housekeeping maintenance. (SCA 104) 3(1+2)

Theory:

Storage of food grains and cooked food, Safety precautions for gas oven, electric oven and heater, laundry and linen care &management, Bed Making and arrangement of housekeeping & space management. Importance and methodology of cleanliness, and hygiene environment,

Practical:

Identify kitchen related personal hygiene, cleaning methods of food and food contacting areas, cleaning of equipment, utensils and clothes, Storage of food grains and cooked food, Demonstration on knowledge of laundry and linen management, Budget and expenditure management, Knowledge of Bed Making and arrangement of housekeeping & space management.

V. Environment & Seasonal effect in different region. (SCA 105) 2(1+1)

Theory: Orientation on effect of climate and environment on the human body, Food to be given in different climate, Exercise to be done as per climate condition, Specific problems which might occur for male/female and its care, things necessary to make the geriatric feel safe and comfortable

Practical: Identification of old age specific problems, identification of environment and climatic changes, identification of foods to be given due to climate change.

VI. Psychological Care & Counseling. (SCA 106) 2(1 + 1)

Theory:

Cognitive, language and socio-emotional development, Factors affecting development stress management, positive attitude, Time management, Leadership, Importance of Interpersonal relationship, Old Age problem related to psychological effect like memory loss, exit tendency, depression, aggression, and suicidal tendency, etc. Definition, importance and concepts, steps in counseling, importance, qualities of a counselor, role of a counselor, Individual, group & family counseling its type, Counseling of geriatric related to ageing process,

Practical:

Understanding old age problems &Identification of old age mental health problems in local community, forming groups and encouraging activities, Importance of family, visitors and social group.

VII. Basic Computer Skills (SCA 107) 2(0 + 2)Theory:

Nil.

Practical:

Identification of different input /output devices– CPU, VDU, Keyboard, Interconnecting Cords, Hard disk, Key Boarding skills, Pen drive, other USB based Devices. Use of task bar, start button, title bar, mouse, menu and window's help, using My Computer and Recycle bin etc. Operating system; Opening and closing different windows, creating and renaming files and folders, MS word Typing, editing, tabulation & MS Excel for maintaining data, Networking and Internet communication concept; Services on Internet –Websites (www) E-Mails, Voice Mails, Browser and search engines. Searching & Downloading, Printing, saving portion of web page, E-Mail addressing, Inbox, outbox, viewing, sending and saving mails, Sending some mails to various Users (multi-address) & sending attachment and enclosures, Web Page Transaction.

VIII. Institutional Management. (SCA 108) 2**(1 + 1)Theory:**

Introduction to office management; types of correspondence, receipts & dispatch of mail, filing system, classification of mail, Role & function of correspondence. Duties and responsibilities of Old Age Care service personals. Maintenance of daily accounting; Basic principles of accounting, assets, liabilities, cost accounting, material management, stock checking. Maintenance of records; importance of maintaining various records -medicine record, fever record etc. with timing, registers & other documents of old age care, classifying and indexing of records and files & how to obtain them during home-care, legal and ethical issue.

Practical:

Practice on maintenance of registered records; other documents of old age care, Daily accounting, organizing the recreational activities such as group discussion, film show & entertainment, game sports appropriate to old age.

Basic Courses

I. Geriatric diseases& Management (SCA 201) 2 (1+ 1)

Theory:

Introduction to disability: Disease, impairment, Disability, handicap and changing concepts, Geriatric disease; Diabetes, hypertension, low BP, Osteoporosis, memory loss and Alzheimer disease, Arthritis, Lung Diseases, Heart Diseases, Parkinson diseases, Depression, Flu, weight gain, dental problem, cataract, skin diseases, factors responsible and its management,.

Practical:

How to administer the medicines on time, Care during fever, loss of consciousness and breathlessness etc, Taking & Recording of temperature, pulse, respiration, blood pressure, blood sugar etc, Simple sterilization methods and prevention of cross infection, Utilization of different types of aids in different situation, Introduction to different bed and sitting adjustment for bed ridden person and person with issues of spinal cord. Demonstration of skills in comfort &pain management.

II. Old age population policies and Act. (SCA 202) 2(2+ 0)

Theory:

National programme for health care of elderly, Interim disability assistance programme for elderly, National Policy on Older Persons and its Implementation, Describe the general provisions/schemes/promotions etc. under laws related to geriatric welfare, Help age India, long-term care services for the elderly, community services for the elderly, Integrated programme for older persons. Banking norms and relaxations, Acts on Taxation for elderly citizens, pension schemes, NPS scheme, government allowances. Provision and facilities for senior citizens in central government and state government.

Practical:

Nil

Advanced courses

I. Anatomy, physiology and human development. (SCA 301) 2 (1+ 1)

Theory:

Basic knowledge about the structure and function of different parts of body for different body Systems: Basics on Musculoskeletal, Nervous, Cardiovascular, Respiratory, Digestive, Urinary, Reproductive system, endocrine organs &Sensory organs its structure and function, physiology. Degeneration of different organ function during the old age, identify common symptom of dysfunction of major organ and its effects on living.

Practical:

Identification of Physiology and Anatomy of Human body, diagram formation, Developing educational extension materials/ literatures for awareness among family/ community.

II. Types of Developmental challenges. (SCA 302) 2 (1 + 1)

Theory:

Types of Disability: Visual Impairment, Hearing & Speech Impairment, Locomotors Disability, Mental Retardation, Multiple Disability, Mental Illness, Autism, Cerebral palsy. Prevention, Causation, psychosocial impact of disability on the individual/family /community. Statutory provisions in the field of disability, concessions benefits under various schemes of Govt. of India for persons with disability.

Practical:

Identify the Physical and mental disability among the old age population in the local /family/community, Planning, recreational activities for disabled old age; Presentation of case study reports.

SEMESTER II

1. **Foundation:**

Gap assessment in management at village level through PRA and assistance. The candidates will be required to identify the gaps in the adoption of the assistance required at their attached units/senior citizens based on semester-I experiences. The

candidates will be provided assessment questionnaire, on this basis they will analyze gap based on information gathered during giving assistance. The sheet will address following questions for gap assessment:

a). Class participation and assignment (PRA techniques, data collection, Case Study with one week old age assistance with different categories of old persons, Report Submission

b). Analysis and presentation of report

2. Basic: Foundation +

a) To identify he old age Problem sunder different socio-economic groups in the field.

b) After Assessment suggest the possible solutions for the problems of the old populationcare &under different categories.

c) Report submission and Presentation.

3. Advanced: Foundation + Basic +

a) Visit to institutions for aged and critical evaluation.

b) Project proposal on different issues of old age problems and presentation.

c) Laws regarding the activity to be observed, if any and give presentation.

4. Practical Skill Acquired with Stepwise assessment

The candidates will be assessed for the practical skills acquired according to the job responsibilities assigned to them as follows:

S. No.	Course	Job responsibilities
1.	Foundation	Lab and field participation &practical file maintenance.
2.	Basic	Lab and field participation & practical file maintenance.
3.	Advanced	Lab and field participation & practical file maintenance.

Job opportunities after completing the course:

1. Care taker of old age homes.
2. Care taker at nursing homes, medical, trauma center's etc.

3. Counselor in NGO's.
4. Data entry operators in projects related to old age populations.
5. Care taker in mental hospitals.
6. Can open NGO for working with elderly persons.
7. Work as a counselor for senior citizens welfare.
8. Freelance care taker.

List of infrastructure required for conducting the course

S. No.	**Rooms**	**Specification and quantity**
1.	Smart Class room	One with the sitting arrangement of 20 students and digital podium
2.	Laboratory 15 X 12 feet	One with sink attached with continuous water supply.
3.	Washing room 6 X 8 feet	One equipped with sink, toilet and continues water supply
4.	Kitchen 15 X 12 feet	One with sink attached with continuous water supply and kitchen cabinets.
5.	Office chamber 15'X 12'	One
6.	Continuous electric supply	-

List of equipment required for conducting the course

Sl. No.	**Equipment**	**Quantity**	**Amount**
1.	Laptop and accessories	5	Rs3,25,000
2.	Modem /Wi-Fi for internet connectivity	1	Rs. 20,000
3.	Printer and Scanner	1	Rs. 25,000
4.	Projector	1	Rs. 80,000
5.	Xerox machine	1	Rs. 2,00,000
6.	Kitchen Utensils and equipment	1	Rs. 80,000
7.	Electrical kitchen appliances	-	Rs. 25,000

8.	Blood pressure measuring equipment	1	Rs. 5,000
9.	TV (Plasma TV) 55 inch	1	Rs. 50,000
10.	Mike set with sound system	1	Rs. 35,000
11.	Weighing machine	3	Rs. 6,000
12.	Height measuring scale	1	Rs. 5,000
13.	Thermometer	5	Rs. 1,000
14.	Forehead Thermometer Gun for Body Temperature	5	Rs. 20,000
15.	Fingertip pulse Oximeter	5	Rs. 10,000
16.	Class room Chair	20	Rs. 60,000
17.	Demonstration table	1	Rs. 20,000
18.	laboratory chair	20	Rs. 30,000
19.	White board 4X6 with stand	2	Rs. 7,000
20.	Display board	1	Rs. 4,500
21.	Glass Almirah	1	Rs. 15,000
22.	Air Cooler	1	Rs. 10,000
23.	File rack	1	Rs. 5,000
24.	Ceiling fan	2	Rs. 5,000
25.	Stand fan	2	Rs.10,000
26.	Room mat	-	Rs. 25,000
27.	Computer table with chair	5	Rs. 25,000
28.	Electric hand Sanitizer	1	Rs. 35,000
29.	Gas stove plus cylinder	1	Rs. 20,000
30.	Curtain for two room	-	Rs. 25,000
31.	Laboratory Teaching aids	-	Rs. 50,000
32.	Display plate	25	Rs. 10,000
33.	Training and Literature material	-	Rs. 50,000
34.	Stationary items	-	Rs. 50,000
35.	Fridge	1	Rs. 35,000
36.	Camera	1	Rs. 50,000
37.	Godrej Almirah	1	Rs. 20,000

38.	Led Board 4 x 3	3	Rs. 20,000
39.	Air Conditioner	1	Rs. 50,000
40.	Scientist Table and Chair	1	Rs. 50,000
41.	Vaccum cleaner	1	Rs. 10,000
42.	Inverter Battery	1	Rs. 20,000
43.	Kitchen Table	1	Rs. 2,000
44.	Kitchen Sink	1	Rs. 4,000
45.	R.O. Water Cooler	1	Rs. 25,000
46.	Sanitary item	-	Rs. 30,000
47.	Transportation and vehicle hiring	-	Rs. 50,000
48.	POL for bus, office vehicle, generator etc.	-	Rs. 2,00,000
49.	Miscellaneous/contingency	-	Rs. 1,00,000
	Total		**Rs. 20,09,500**

Man Power -

Sl. No.	**Designation**	**Quantity**	**Remuneration**	**Duration**	**Total Remuneration**
1.	Program Assistant	1	Rs. 15,000	12 months	Rs. 1,80,000
2.	Skill supporting staff for Kitchen	1	Rs.7,500	12 months	Rs. 90,000
3.	Skill supporting staff for assistance	1	Rs. 7,500	12 months	Rs. 90,000
Total					Rs. 3,60,000

CERTIFICATE COURSE FOR KVK

"NURSERY MANAGEMENT"

Syllabus

DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA (SAMASTIPUR) BIHAR

Certificate Course on "Nursery Management Assistant"

Introduction

In an uncertain world, the nursery industry offers a sustainable future. Plants are something that mankind will always need. Plant nurseries produce billions of plants every year. They underpin forestry, vegetable, fruit, landscape, cut flower and parks industries. There will always be a demand for plants; and this means there will always be a need for plant nurseries. Across the world, nurseries can be seen in all shapes and sizes. Some are small family businesses, and others large scale commercial operations employing large numbers of people and grow millions of plants. Whatever the size though, a nursery requires effective management to be sustainable and financially profitable. Nurseries have always tended to be mainly small businesses employing fewer than five persons. Larger operations, particularly in nursery retailing, have gained a significant market share in recent decades; but the nature of the industry is such that there will always be a place for small, specialist operations, which cannot be filled by larger chains.

There are many hundreds of thousands of different plants that are cultivated. When it comes to growing and supplying a specialist range of plants (eg. carnivorous plants; specialty flowers); it really requires a nurseryman who has a highly focused passion for that group of plants, to be able to grow them well and provide the specialized knowledge and advice that a customer needs. There are always good opportunities for new nurseries to establish; provided they are selective in what they grow and that they maintain adequate standards in the quality of plants they produce.

In today's world, many nurseries fail; not because they don't have good horticultural practices; but mostly because they do not have good business management skills and practices and in India per se, skilled nurserymen are in dearth who are certified and are having scientific acumen. This course offered by RPCAU not only aims to instil scientific understanding of nursery management but also aims to raise entrepreneur with management and business skills.

The course is designed to benefit the students in building an understanding about the role of nursery raising and plant propagation in horticultural crops (importance of horticultural crops, establishment of nursery, various propagation techniques, nursery raising and handling of horticultural crops) and learn the skills behind various nursery and propagation techniques. The trainees will learn the technological application and concepts on raising quality planting materials and help them to develop confidence toward entrepreneurship.

The persons trained in nursery management are responsible for executing various operations involved in the production of true to type quality planting material. Any person, who has basic understanding of the scientific principles and laboratory equipment, can be trained and become competent in nursery management. This training module has high self-employment and business level up gradation opportunities. The course focuses on providing hands-on training to the farmers and students for learning the basics of nursery management. The candidates completing this course can be employed as nursery management technician, nursery supervisors in research institutes and industries. They will also become competent in establishing low cost/high cost nursery business plan with limited place and earn more income.

The **Major Objectives** of the programme will be:

1. To provide theoretical knowledge and practical exposure in the field of nursery management, with special emphasis on development of operational competence among the participants.
2. To train manpower suited for horticultural industries and Research centres.
3. To develop practically skilled human resource for the production of true to type quality planting
material in horticultural nurseries / institutions.

COURSE STRUCTURE

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table 1).

Table 1: Qualification category wise credit load

S. No.	Course/student	Eligibility	Credit Hrs		
			Semester I	Semester II	Total
1.	Foundation	8th pass	20	28	48
2.	Basic	10th pass	24 (20+4)	28	52
3.	Advanced	12th pass	28 (24+4)	28	56

Theoretical and practical knowledge will be offered to the candidates in the first semester to provide them the basic understanding of the course. The list of courses offered under different programmes is given in table 2.

Table2. List of courses offered

Foundation courses
Total credit hrs: 20 (12+8)

Course No.	Course Code	Course Title	Credit Hrs
1.	NMA 101	Introduction to Horticulture & Nursery management	2 (2+0)
2.	NMA 102	Sexual plant propagation	3 (3+0)
3.	NMA 103	Cutting and layering techniques	2 (1+1)
4.	NMA 104	Plant grafting techniques	3 (1+2)
5.	NMA 105	Plant budding techniques	3 (1+2)

6.	NMA 106	Propagation through specialized structures	2 (1+1)
7.	NMA 107	Training and pruning	3 (1+2)
8.	NMA 108	Nursery tools and equipments	2 (2+0)
Basic courses [Foundation courses (20) + extra courses (4)] Total credit hrs: 24 (15+9)			
9.	NMA 201	Nursery registration and economics	2 (2+0)
10.	NMA 202	Plant Nutrition and use of PGRs and its Management in Nursery	2 (1+1)
Advanced [Basic (24) + extra courses (4)] Total credit hrs: 28 (19+09)			
11.	NMA 301	Protected structures utilised for nursery raising	2 (2+0)
12.	NMA 302	Novelty/speciality skills	2 (2+0)

The second semester will consist of Village /Laboratory attachment where the candidates will be given exposure to the commercial establishments covering following parameters:

Course/Students	Credit Hrs	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK, 10 marks Attached Unit)
Attendance		10 marks
Practical Exam		50 marks

***The assignments will cover the following aspects for each course:**

A. Foundation : Gap assessment in management at village level through PRA and stepwise assistance required.

B. Basic : Foundation + Problems in adoption and options to overcome under different size entrepreneurs.

C. Advanced : Basic + 1. Dynamics of: Input – Yield – Economics
2. Laws regarding the activities, if any

DETAILED SYLLABUS

SEMESTER I

1. Course No. 1: Introduction to Horticulture & Nursery management: NMA 101 (2+0)
Theory: Definition, branches, scope and importance of Horticulture and Nursery raising, Nursery establishment, Different media used in horticultural nursery, Chemicals and PGRs in plant propagation.
Practical: NIL
2. Course No. 2: Sexual plant propagation: NMA 102 (3+0) Theory: Advantages and disadvantages of propagation in Horticultural crops, Seed beds, types and utilities, Plug nursery raising and its advantages, Seed germination in horticultural crops, Dormancy problem and methods of breaking dormancy, Seed storage, Do's and don'ts in seed storage and packaging, Selection and maintenance of mother trees, collection of scion wood stick, role of rootstock and scion
Practical: NIL

3. Course No. 3: Cutting and layering techniques: NMA 103 (1+1)
Theory: Types (Stem, leaf and root cutting),Factors affecting rooting in cuttings, Advantages& disadvantages and types of layering (Tip layering, simple, serpentine, trench, herbaceous, air and mound layering), Factors affecting rooting in layering
Practical: Rooting hormones and methods of application, practice on preparation of stem cuttings, practice on preparation on air layering.

4. Course No. 4: Plant grafting techniques NMA 104 (1+2)
Theory: Graft union and factors affecting healing of graft union, attached and detached methods , inarching, wedge grafting, tongue grafting, Veneer grafting, Side grafting and epicotyl grafting, special types of grafting (softwood , epicotyl, micro-grafting)
Practical: Practice on grafting through inarching, wedge grafting, tongue grafting, Veneer grafting, side grafting and epicotyl grafting.
5. Course No. 5: Plant budding techniques NMA 105(1+2)
Theory: Bud wood selection and preparation of bud stick, shield or T-budding, inverted T-budding, patch budding, I-budding, ring budding, chip budding, flute budding, forkert budding
Practical: Practice on preparation of Shield/T-budding, patch budding, I-budding.

6. Course No. 6: Propagation through specialized structures: NMA 106 (2+1)
Theory: Tuber, bulb, corms, rhizome, runners, suckers, offsets.
Practicals: Practice on preparation of planting materials through specialized vegetative structures.

7. Course No. 7: Training and pruning: NMA 107 (0+2)
Theory: Objectives and types of training and pruning, maintenance of mother block.
Practicals: Training and pruning operations on fruit plant mother block.

8. Course No. 8: Nursery tools and equipments: NMA 108 (2+0)

Theory: Layout of nursery, Plant Propagation Structures, Nursery tools and equipments.
Practical: NIL

9. Course No. 9: Nursery registration and economics: NMA 201 (2+0)
Theory: Nursery Registration act, economics of Nursery Development and budgeting, Record Management, Online Nursery Sales Systems, Government Regulations in Horticulture Nursery
Practical: NIL

10. Course No. 10: Plant Nutrition and use of PGRs in Nursery: NMA 202 (0+2)
Theory: Nutritional program, Fertigation, different chemical methods of controlling plant appearance by the use of PGRs
Practical: Breaking of seed dormancy with chemicals and PGRs, rooting hormones and methodsof application, preparation of hormonal concentrations ,calculation on Fertilizers/nutrients

11.Course No. 11: Protected structures utilised for nursery raising: NMA301 (2+0)

Theory: Mist chamber, Propagation structures, shade net, poly house, hot bed, sand bed, Makeshift poly tunnel, Cold Frame, Lath house, Use of Plastics and their sustainable replacements **Practical**: NIL

12. Course No. 12: Novelty/speciality skills: NMA 302 (0+2)
Theory: Terrarium making, Bonsai, Dish garden, floristry, wedding décor etc.,
Practical: NIL

SEMESTER II

1. A) Foundation: Gap assessment in management at village level through PRA and assistance.
The candidates will be required to identify the gaps in the adoption of the technology at their attached units/farmers field. The candidates will be provided assessment questionnaire; on this basis they will analyse gap based on information gathered. The sheet will address following questions for gap assessment:

1. List of plant varieties more suitable in the region.
2. Study of the locals regarding need of nursery technology.
3. List of equipments for nursery establishment/strengthening.
4. List of records, budgeting and economics in light of requirements.
5. Details of plan to fill the gap in respective study area.

B) Basic:Foundation + Problems in adoption and options to overcome under different size enterprinuers.
The candidates pursuing basic course will be required to identify the problems in commercial applications of nursery management and suggest the possible solutions. In addition to the aspects addressed by the foundation course assessment questionnaire, they will address following additional aspects:

1. Identification of problems in commercial exploitation of the establishment.
2. Suggestions for creating awareness among the local populations.

C) Advanced: (a) Basic + Dynamics of: Input – Yield – Economics
(b) Laws regarding the activity to be observed, if any

The candidates pursuing advanced courses will address following aspects in addition to the aspects addressed by the foundation and basic candidates:

1. The minimum standards for the nursery establishment.
2. Additional input based gap filling assessment for economics, based on information gathered.
3. Identification of the supply chain and their shortcomings.

2. Practical Skill Acquired with Stepwise assessment

The candidates will be assessed for the practical skills acquired according to the job responsibilities assigned to them as follows:

S. No.	Course	Job responsibilities
1.	Foundation	Procurement, establishment and maintenance of selected mother plants, propagation
2.	Basic	Procurement, establishment and maintenance of selected mother plants, propagation , distribution and sale of propagules, observations and calculation of economics
3.	Advanced	Procurement, establishment and maintenance of selected mother plants, propagation , distribution and sale of propagules, observations and calculation of economics , erecting different propagation structures, propagation laws to be followed.

List of Infrastructures Required

S. NO.	Rooms	Specifications
1.	Smart classroom	One with the seating arrangement of 20 students and digital podium
2.	Poly House 15m X 6 m X 6m	One equipped with temperature and humidity control, fogging system with sprinkler and exhaust system
3.	Office chamber 15'X 12'	One
4.	Continuous electric supply	-

List of equipments required

S. No.	Equipments	Quantity	Justification
1.	Double water Distillation Apparatus	**1**	Distilled water is needed for preparing the different concentrations of PGR
2.	Electronic Balance single pan	**1**	Weighing the chemicals and other materials
3.	Microwave oven	**1**	Sterilizing the glassware's etc.
4.	Refrigerator 300 L	**1**	Keeping the chemical safe and in cool climate
5.	Air conditioner (1.5 ton)	**1**	Needed for acclimatising the collected materials , mother plants, rooted plants etc.
6.	Voltage stabilizer 2.4 KVA	**1**	For equipments / smooth electricity supply without fluctuation
7.	Heat Convector	**2**	Required for maintaining the raised temperature in green house during severe winter

List of miscellaneous and consumable items needed

S.No	Particular	Approximate cost (Rs.)
1.	**Farm Items:** (Irrigation pipe different sizes with jointer, Lay outer, spades, khurpa, roap, sutali, different sizes of poly bags, measuring tape, Trowel Falcon, watering cane, secateurs, sickle, pruning secateurs, budding strip (Polythene), Cocopeat, Vermiculite , Perlite, cutting knife , grafting knife , budding knife , girldling knife , portary, grafting tape , garden rake ,loader, ladder, hand glove, hand sprayer , foot sprayer etc.)	500000/-
2.	Equipments (Electric hedge cutter, etc.)	300000/-
3	Glassware and chemicals (Beaker (500 ml), Beaker (1000 ml) , Test Tube , Test Tube stand etc. and IBA GA3 etc.)	200000/-
Total		10,00,000/-

CERTIFICATE COURSE FOR KVK

"Plant Tissue Culture"

Syllabus

Dr. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY,
PUSA (SAMASTIPUR) BIHAR

INTRODUCTION

Plant tissue culture is an important propagation method which is used to develop plants from very small parts of plants in a laboratory. It is an important tool for both basic and applied aspects of plant biotechnology. It has commercial applications particularly for the propagation of vegetatively propagated plants and production of genetically identical plants. This technique utilizes a small part of plant known as explants as a starting material to produce complete plant, thus the technique is known as micro propagation. The explants can be leaves, seeds, anther, nodal stem, shoot apex, flowers, embryo etc. Since the plants are produced from vegetative parts of the plant, they are genetically identical to the mother plant. Thus, this method has become a technique of choice for the production of planting material of economically important plants like banana, sugarcane, grapes, orchids, potato and others. Through this technique, large amount of propagative materials can be produced in a very short duration in a limited space. In thisscenario, a trained manpower in handling the various aspects of plant tissue culture is highly looked-for.

The persons trained in plant tissue culture are responsible for executing various operations involved in the production of tissue culture plants in laboratory. They are able to produce quality planting material and complete the various steps involved. Any person, who has basic understanding of the scientific principles and laboratory equipment, can be trained and become competent in micro propagation. The course focuses on providing hands-on training to the farmers and students for learning the basics of plant tissue culture and providing an insight to laboratory practices. The candidates completing this course can be employed as laboratory technicians, supervisors in research institutes and industries. They will also become competent in establishing their own laboratory for the production of quality planting material.

The major objectives of the programme will be:

1. To provide theoretical knowledge and practical exposure in the field of plant tissue culture, with special emphasis on development of operational competence among the participants.

2. To train manpower suited for Plant Tissue Culture Industry and Research centres.

3. To develop practically skilled human resource for engagement in micro propagation industryof economically important plants.

COURSE STRUCTURE

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table 1).

Table 1: Qualification category wise credit load

S. No.	Course/student	Eligibility	Credit Hrs		
			Semester I	Semester II	Total
1.	Foundation	8th pass	20	28	48
2.	Basic	10th pass	24(20+4)	28	52
3.	Advanced	12th pass	28(24+4)	28	56

The candidates will be offered courses in the first semester to provide them knowledge of the basic understanding of the course. The list of courses offered under different programmes is given in table 2.

Table 2. List of courses offered

Foundation courses
Total credit hrs: 20 (14+6)

Course No.	Course Code	Course Title	Credit Hrs
1.	PTC 101	Concept of solutions	2 (2+0)
2.	PTC 102	Plant Biology	3(3+0)
3.	PTC 103	History and scope of plant tissue culture	2(2+0)
4.	PTC 104	Basic Laboratory techniques	3(0+3)
5.	PTC 105	Concepts of Plant Tissue culture	3(3+0)
6.	PTC 106	Plant Tissue culture media	3(2+1)
7.	PTC 107	Plant Tissue culture techniques	2(0+2)
8.	PTC 108	Record Keeping	2(2+0)

Basic courses [Foundation courses (20) + extra courses (4)]
Total credit hrs: 24(16+8)

9.	PTC 201	Principles of Micro propagation	2(2+0)
10.	PTC 202	Micro propagation Techniques	2(0+2)

Advanced [Basic (24) + extra courses (4)]
Total credit hrs: 28(18+10)

11.	PTC 301	Advanced Micro propagation	2(2+0)
12.	PTC 302	Techniques in Advanced Plant Tissue Culture	2(0+2)

SEMESTER- II

The second semester will consist of Village /Laboratory attachment where the candidates will be given exposure to the commercial establishments/Farmers covering following parameters:

Course/Students	Credit Hrs	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK, 10 marks Attached Unit)
Attendance		10 marks
Practical Exam		50 marks

***The assignments will cover the following aspects for each course:**

A. Foundation : Gap assessment in management at village level through PRA and stepwise assistance required.

B. Basic : Foundation + Problems in adoption and options to overcome under different socio-economic groups.

C. Advanced : Basic +1. Dynamics of: Input – Yield – Economics
2. Laws regarding the activities, if any

DETAILED SYLLABUS

SEMESTER I

1. Course No. 1 CONCEPT OF SOLUTIONS :PTC 101 (2+0)

Theory

Role of water in biological system, Acid base concepts: Types of acids and bases, acid base conversions, Concept of buffers and commonly used buffers, Concept of measurement of concentration: Molarity, molality, normality, percentage, ppm, pH scale and methods of measurement, Titration and neutralization, Conversion formula.

Practical: NIL

2. Course No. 2PLANT BIOLOGY :PTC 102 3+0

Theory

Introduction to Plant Growth Science and biochemical processes: Transpiration, Photoperiodism, Plant water relations, Photosynthesis and Respiration, Plant Parts -Stems, Leaves, Roots, Buds, Flowers and fruits, Cell biology: structure, type and functions of cells, Types of Plant Tissue, Primary and secondary metabolites: functions and importance for plant growth development, Plant growth regulators: mode of action of auxins, cytokinins, gibberellins, abscisic acid, ethylene and other hormones and their role in micropropagation, Role of major and minor elements in plant growth and development, Concept of plant disease resistance**.**

Practical: NIL

3. Course No.3 HISTORY AND SCOPE OF PLANT TISSUE CULTURE: PTC 1032+0

Theory

History of plant tissue culture: major breakthroughs achieved in the technique; role of plant tissue culture assistant: understanding the job responsibilities; terminology used in plant tissue culture: understanding the scientific nomenclature; Commercial applications of plant tissue culture.

Practical: NIL

4. Course No.4 BASIC LABORATORY TECHNIQUES :PTC 104 0+3

Theory: NIL

Practicals

Laboratory organization: Requirements for establishing plant tissue culture laboratory; Different chambers of plant tissue culture lab and its requirements; Cleaning and Washing techniques; Handling of instruments; Concepts of laboratory chemicals and grading; handling of harmful chemicals; Preparation of buffer solutions, molar solutions; Maintenance of pH of the given solution; Sterilization techniques: Dry heat and moist heat sterilization, sterilization of glasswares; Laboratory safety guidelines: Maintenance of personal hygiene and lab sanitation; use of first aid and fire extinguisher.

5. Course No. 5 CONCEPTS OF PLANT TISSUE CULTURE:PTC 105 3+0

Theory

Concept of totipotency and morphogenesis: Organogenesis and somatic embryogenesis; Concept of aseptic cultures; Concept of differentiation and regeneration; Stages in development of tissue culture plant: Methods of Shoot Induction and Proliferation, Adventitious Roots; Requirements for the growth of tissue culture plants: light, temperature, moisture and greenhouses; Various types of culture: callus, suspension, nurse, root, meristem; micropropagation and its commercial applications.

Practical: NIL

6. Course No. 6 PLANT TISSUE CULTURE MEDIA: PTC 106 2+1

Theory

Nutritional requirements of *in-vitro* cultures; Types of media: Classification based on nutrient composition and texture; Culture media components and modifications ; Role of different macro and micro nutrients and vitamins in growth of *in vitro* plants; Principles of Using Plant Hormones and other chemical growth treatments: their effects on *in vitro* culture and regeneration; Solidifying agents; Other media additives; Concept of selection of media; Sterilization techniques; Different commercial media.

Practicals

Preparation of stock solutions of the major components, minor components, amino acids and vitamins, iron of Murashige and Skoog's medium; preparation of stock solutions of IAA, 2,4-D, NAA, BAP, kinetin, TDZ; Preparation of Murashige and Skoog's medium; sterilization techniques of the media, preparation of commercial media.

7. Course No. 7 PLANT TISSUE CULTURE TECHNIQUES :PTC 107 0+2

Theory: NIL

Practicals

Selection, planting and maintenance of mother plants; Explant preparation techniques – banana sucker and flower bud; nodal bud of sugarcane; apical bud, leaves and nodal stem of Solanaceae plant: Technique of sterilization and aseptic manipulation of explants; Aseptic inoculation techniques; Maintenance of callus culture; regeneration of callus; techniques of subculture; Maintenance of culture incubation conditions.

8. Course No. 8 RECORD KEEPING :PTC 108 2+0

Theory

Maintenance of inventory and up-to-date record of equipments and chemicals; Concept of taking observations: monitoring the culture for absence of infection, presence of growth, response and other parameters; monitoring the acclimatization and hardening of the plants; data preparation; photography; maintenance of log books and records; report preparation.

Practical: NIL

9. Course No. 9 PRINCIPLES OF MICROPROPAGATION: PTC 201 2+0

Theory

Concept of clonal propagation; *In vitro* grafting; Stages of micropropagation; Direct and indirect organogenesis; Direct and indirect somatic embryogenesis; Meristem culture and applications; Various types of organ culture: Axillary bud culture, nodal stem culture, anther culture, pollen culture, ovule culture, embryo culture, ovary culture, endosperm culture; Applications of micropropagation; Concept of somaclonal variations; Low-cost methods of micropropagation.

Practical: NIL

10. Course No. 10 MICROPROPAGATION TECHNIQUES : PTC202

0+2Theory: NIL

Practicals

Establishment of axillary bud, seed and callus culture; Initiation of multiple shoot development; Subculture & Observation; Rooting; Acclimatization and Hardening; Observations and record keeping.

11.Course No. 11 ADVANCED MICROPROPAGATION: PTC 301 2+0

Theory

Advances in micropropagation techniques; Shoot tip culture for production of virus free plants; Anther culture and haploid production; Somatic cell and protoplast culture; Understanding the concepts of somaclonal variations; embryo culture; Role of plant tissue culture in germplasm conservation; role of plant tissue culture in crop improvement.

Practical: NIL

12. Course No. 12 TECHNIQUES IN ADVANCED PLANT TISSUE CULTURE :PTC 302 (0+2)

Theory

Establishment and maintenance of meristemculture; antherculture: isolation of anther and its aseptic inoculation, maintenance of culture, cytological studies of the isolated anther; mature and immature embryo culture; establishment of suspension culture; cytological studies of the cultured tissue; biochemical tests of the cultured tissues.

Practical: NIL

SEMESTER II

1. Foundation: Gap assessment in management at village level through PRA and assistance.

The candidates will be required to identify the gaps in the adoption of the technology at their attached units/farmers field. The candidates will be provided assessment questionnaire, on this basis the will analyze gap based on information gathered. The sheet will address following questions for gap assessment:

1. List of plants requiring plant tissue culture in the region.
2. Study of the locals regarding need of this technology.
3. List of equipments for lab establishment/strengthening.
4. List of chemicals in light of requirements.
5. Details of plan to fill the gap in respective study area..

2. Basic: Foundation + Problems in adoption and options to overcome under differentSocio-economic groups (RRF/RPF).

The candidates pursuing basic course will be required to identify the problems in commercial applications of plant tissue culture techniques and suggest the possible solutions. In addition to

the aspects addressed by the foundation course assessment questionnaire, they will address following additional aspects:

1. Identification of problems in commercial exploitation of the establishment.
2. Suggestions for creating awareness among the local populations.

3. Advanced: (a) Basic + Dynamics of: Input – Yield – Economics
(b) Laws regarding the activity to be observed, if any

The candidates pursuing advanced courses will address following aspects in addition to the aspects addressed by the foundation and basic candidates:

1. The minimum standards for the tissue culture plant produced.
2. Additional input based gap filling assessment for economics, based on informationgathered.
3. Identification of the supply chain and their shortcomings.

4. Practical Skill Acquired with Stepwise assessment

The candidates will be assessed for the practical skills acquired according to the job responsibilities assigned to them as follows:

S. No.	Course	Job responsibilities
1.	Foundation	Laboratory maintenance, Procurement and maintenance of mother plants, Aseptic culture
2.	Basic	Laboratory maintenance, Procurement and maintenance of mother plants, Aseptic culture, Observation and photography
3.	Advanced	Laboratory Maintenance, Procurement and maintenance of mother plants, Aseptic culture, Observation and photography, Subculture and propagule multiplication, acclimatization and hardening

LIST OF INFRASTRUCTURES REQUIRED FOR THE ESTABLISHMENT OF PLANT TISSUE CULTURE LAB

S. NO.	Rooms	Specifications
1.	Washing room 15'X 12'	One equipped with two sink of size 45cm X 60 cm and continuous water supply
2.	Media Room 15'X 12'	Two equipped with almirah and cup boards and one 45 cm X 60cm sink
3.	Inoculation room 15'X 12'	One equipped with Air conditioner (1.5 ton)
4.	Incubation room 15'X 12'	Two equipped with temperature, humidity and light control system
5.	Smart classroom	One with the seating arrangement of 20 students and digital podium
6.	Poly House 15m X 6 m X 6m	One equipped with temperature and humidity control, fogging system with sprinkler and exhaust system
7.	Office chamber 15'X 12'	One
8.	Continuous electric supply	-

LIST OF EQUIPMENTS REQUIRED FOR THE ESTABLISHMENT OF PLANT TISSUE CULTURE LAB

S. NO.	EQUIPMENT	QUANTITY
1.	Autoclave	**2**
2.	LPG stove with gas connection	**1**
3.	Horizontal Laminar Air flow single user	**2**
4.	Hot Air oven	**2**

5.	Double water Distillation Apparatus	**2**
6.	Electronic Balance single pan	**2**
7.	pH meter	**2**
8.	Microwave oven	**1**
9.	Glass Bead sterilizer	**2**
10.	Magnetic stirrer with hot plate	**2**
11.	Refrigerator 300 L	**2**
12.	Air conditioner (1.5 ton)	**4**
13.	Tissue culture racks (Size 5’8’’)	**12**
14.	Voltage stabilizer 2.4 KVA for incubation room	**1**
15.	Central voltage stabilizer 10 KVA	**1**
16.	Photoperiodic morphogen controller	**2**
17.	Cooling system	**2**
18.	Sequential Timer	**2**
19.	Switching Unit	**2**
20.	Lux meter	**2**
21.	Humidifier	**2**
22.	Heat Convector	**2**
23.	Rotatory Shaker	**1**
24.	DG Set 40 KVA- Installation, Commissioning & Shelter	**1**
25.	Bottles and tubes washing machine	**1**
26.	Pass box	**2**

LIST OF MISCELLANEOUS ITEMS AND CONSUMABLES FOR THE ESTABLISHMENT OF PLANT TISSUE CULTURE LAB

S. NO.	ITEM	APPROX COST (INR)
1.	Chemicals	**5, 00, 000**
2.	Plant tissue Culture tubes	**50, 000**
3.	Culture bottles	**1,00,000**
4.	Reagent Bottles (100 ml, 250 ml, 500 ml, 1000 ml)	**25,000**
5.	Conical Flasks (100 ml, 250 ml, 500 ml, 1000 ml, 2000 ml)	**25,000**
6.	Petri plates	**10, 000**
7.	Glass rod Spatula Long forceps Scalpel Spirit lamp pH paper Wash Bottles Container for storage of Distilled water Test tube racks Test tube Baskets Dropper Tube cleaning brush Scissor Labelling sticker	**1,00, 000**

	Blotting paper Tissue roll Gloves and mask Beaker tongs Aluminium foil Butter paper Plastic gauze Germination paper Hand sanitizer	
8.	Glass Pipette (5 ml, 10 ml)	**10, 000**
9.	Beaker (25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml, 2000 ml)	**25, 000**
10.	Volumetric Flask ((100 ml, 250 ml, 500 ml, 1000 ml))	**25, 000**
11.	Measuring cylinder (10 ml, 25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml)	**25, 000**
12.	Micropipette (10 µl, 20 µl, 100 µl, 200 µl, 1000 µl)	**50,000**
TOTAL		**20, 00, 000**

CERTIFICATE COURSE FOR KVK

"Artificial Insemination & Embryo Transfer technology"

(A.I. & E.T.T.)

Syllabus

Dr. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY,
PUSA (SAMASTIPUR) BIHAR

INTRODUCTION

Productivity of Indian dairy animals is low that is 1860 litre per year as compared to organization for Economic Co-operation and development (OECD) countries averaging of 7525 litre /year. Among indigenous cattle (both non-descript and high yielding indigenous breeds) the average productivity is only 2000 litre/ per year; for crossbred cattle average productivity is 2902 litre per year. Due to low productivity farmers are not getting remunerative income from rearing of dairy animals. It is fact that dairy animals are more equitably distributed among farmers than cultivable land. So any investment in enhancement in productivity of dairy animals will lead to increase in income of mostly small, marginal and landless farmers. Artificial insemination is important tool for enhancing milk production and productivity of bovines. After making several efforts AI coverage in the country is still limited to 30% of the breedable bovines and 70% of the breedable animals are covered through scrub bulls of unknown genetic merit. In developed nations 100% of the bovine population is under Artificial insemination coverage. One of important impediment in extending AI coverage in the country is shortage of trained AI technicians. For effective AI coverage about 2, 02,469 AI technicians will be required against the present 1, 16,586 AI technicians leaving a gap of 90958 AI technicians.

The primary focus of this course is to enhance productivity of existing bovine population by increasing Artificial Insemination coverage through empowering of rural youth in Artificial Insemination technique in order to impart their services at farmer's doorstep on self sustainable basis through collection of cost for goods and services.

The **Major Objective** of the programme will be:

(i) Provide skilled and educated manpower to deliver artificial insemination services andveterinary first aid to farmers at their doorsteps on self sustained basis.

(ii) Enhancing AI coverage from 30% to 70% of the breedable bovine females in a time boundmanner;

(iii) To develop skilled manpower for engagement in ETT, AI industry and generation of self employment.

COURSESTRUCTURE

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table 1).

Table 1: Qualification category wise credit load

S.No.	course/student	Eligibility	Total credit hours		
			Semester I	Semester II	Total
1	Foundation	8th pass	20	28	48
2.	Basic	10th pass	24(20+4)	28	52
3.	Advance	12 th pass	28(24+4)	28	56

Theoretical and practical knowledge will be offered to the candidates in the first semester to provide them the basic understanding of the course. The list of courses offered under different programmes is given in table 2.

Table 2. List of courses offered

Foundation Courses

Total credit hrs: 20(14+6)

Course No	Course Code	Course Title	Credit Hrs
1	AEA-101	Fundamental of A.I &ETT.	2(2+0)
2.	AEA -102	Basic anatomy of domestic animal'sreproductive organs	3(3+0)
3.	AEA -103	Basic Animal Reproductive Physiology	3(3+0)
4.	AEA -104	History and scope of AI and ETT	2(2+0)
5.	AEA -105	Introduction to AI and ETT Equipments	3(0+3)
6.	AEA -106	Hands on training on AI, Pregnancy Diagnosis and ETT procedure	3 (0+3)
7.	AEA -107	Basics of livestock feeding management	2 (2+0)
8.	AEA -108	Basics of preventive health care of livestock.	2 (2+0)

Basic Courses:(Foundation courses (20) + extra courses (4) Cr. hr.
Basic courses total credit hrs 24 (16+8)

Course No	Course Code	Course Title	Credit Hrs
9	AEA -201	**Principles of semen collection and preservation**	**2 (2+0)**
10	AEA -202	**Handling of microscope and evaluation of Semen samples.**	**2 (0+2)**

Advance course: Basic (24 credit) + extra courses (4 credit) Cr. hr.
Advance coursetotal credit hrs 28 (18+10)

Course No	Course Code	Course Title	Credit Hrs
11.	AEA-301	Concept of Advance Laboratory techniques for ETT	2 (2+0)
12.	AEA-302	Hands on training for advanced Laboratory techniques for ETT, semen and embryo preservation.	2 (0+2)

SEMESTER- II

The second semester will consist of Village /Laboratory attachment where the candidates will be given exposure to the commercial establishments/Farmers covering following parameters:

Course/Students	Credit Hrs	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK, 10 marks Attached Unit)
Attendance		10 marks
Practical Exam		50 marks

***The assignments will cover the following aspects for each course:**

A. Foundation : Gap assessment in management at village level through PRA and stepwise assistance.

B. Basic : Foundation + Problems in adoption and options to overcome under different socio-economic groups.

C. Advanced : Basic + 1. Dynamics of: Input – Yield – Economics
2. Laws regarding the activities, if any

DETAILED SYLLABUS

Semester 1

1. Course No. 1: Fundamental of A.I & ETT - (AEA -101)Credit Hrs.- (2+ 0)

Theory: Introduction to Artificial Insemination (AI) and Embryo Transfer Technology (ETT). Benefits and limitations of AI and ETT. Natural service vs AI and its limitations in livestock. Benefits of cross breeding and genetic improvement of dairy animals. Role of AI in genetic upgradation across states of India. AI vs ETT its advantages and limitations. Fundamental and basic concept of AI and ETT.

Practical: NIL

2. Course No. 2: Basic anatomy of domestic animal and its reproductive organs- (AEA - 102) Credit Hrs - (3+ 0)

Theory: Anatomy of external and internal body parts of dairy animals and their functions. Anatomy of male and female reproductive organ and their functions. Osteology of hind quarters of animals related with position of reproduction organs.

Practical: NIL

3. Course No. 3: Basic Animal Reproductive Physiology- (AEA -103) Credit - (2+ 0)

Theory: Common terms used to understand the reproductive physiology in domestic animals. Basic concept of estrus cycle in domestic animals. Different phases of estrus cycle in animals. Different estrus behavioral signs in animals during estrus period. Basic concept of endocrine control through hormone in reproduction in animals. Hormonal interventions to control reproduction and its limitations.

Practical: NIL

4. Course No. 4: History and scope of AI and ETT- (AEA -104)Credit Hrs.- (2+ 0)

Theory: History of artificial insemination in domestic animals. History of Embryo Transfer Technology. Scope of AI and ETT for upgradation and conservation of breeds of domestic animals. Major breakthrough achieved in AI and ETT. Role of AI and ETT technician towards the society.

Practical: NIL

5. Course No. 5: Introduction to AI and ETT Equipment's- (AEA -105)
Credit - (0+ 3)

Theory: NIL

Practical: Introduction of the list of equipment and accessories used in the process of Artificial Insemination (AI) and ETT. Handling and maintenance of equipment used in AI and ETT. Basic concept of Standard Operating Procedure (SOP) followed during and after AIand ETT procedure. Handling of Liquid Nitrogen (LN2) container during process of AI. Importance of maintaining cold chain and liquid Nitrogen refilling schedule. LN2 conservation measures. Proper method of semen withdrawal from LN2 container, thawing, preparation of AI gun and proper site of semen deposition in female reproductive tract.

6. Course No. 6: Hands on training on AI, Pregnancy Diagnosis and ETT procedure- (AEA -106)Credit - (0+ 3)

Theory: NIL

Practical: Identification of different female reproductive organs on morbid genitalia. Palpation of female genitalia in phantom box and passing AI gun. Structure of LN2 container and checking of LN2 level in the container. **Rectal palpation of female genitalia in live animals.** Passing of AI gun in live animals. Hands on training of proper method for withdrawal of straw from the container, thawing, preparation of gun, site of deposition of semen in female genitalia. Early pregnancy diagnosis through rectal palpation at 60 days and beyond. Introduction to ultrasonography for early pregnancy diagnosis.

7. Course No. 7: Basics of livestock feeding management- (AEA -107)
Credit - (2+ 0)

Theory: Basic aspect of nutrition and concept of ration balancing. Importance of proper nutrition including feeding of vitamins and mineral mixture. Deworming in fertility management with emphasis on adverse impact of micro and macro nutrient deficiency on fertility and reproductive health of animals. Proper balanced ration for dry, pregnant and lactating animals according to milk production.

Practical: NIL

8. Course No. 8: Basics of preventive health care of livestock. - (AEA -108) Credit - (2+ 0)

Theory: Basic knowledge of economically important diseases and their prevention through timely vaccination. Information of recent commercially available vaccine, vaccination schedule, and importance of cold chain for successful vaccination. Process of insurance of animals. First aid treatment in case of emergency and outbreak of disease. Process of timely reporting of animal disease outbreak to the government authorities.

Practical:NIL

9. **Course No. 9: Principles of semen collection and preservation - (AEA -201) Credit - (2+ 0)**

Theory: Basic process of semen collection from bull through artificial vagina. Evaluation of semen quality. Processing of semen for preservation. Different type of semen packing, structureof mini and medium straw along with information printed on straws and its importance. Breed wise semen straw colour codes. Diluent used for semen cryopreservation. Morphology of sperm/ spermatozoa.

Practical:NIL

10. **Course No. 10: Handling of microscope and evaluation of Semen samples. – (AEA -202)Credit - (0+ 2)**

Theory: NIL

Practical: Introduction to microscope and its parts. Types of microscope and basic techniques in handling the microscope. Evaluation of different parameters of semen samples using microscope. Dilution of semen samples to get desired concentration of spermatozoa for artificial insemination and cryopreservation.

11. **Course No. 11:** Concept of Advance Laboratory techniques for ETT- **(AEA -301)Credit - (2+ 0)**

Theory: Introduction to Embryo Transfer Technology (ETT) in domestic animals. Advantages and limitations of ETT. Selection of donor and recipient animals for embryo transfer. Synchronization of estrus in donor and recipient animals. Superovulation using hormonal therapy in ETT. Flushing, collection and evaluation of embryos.

Practical: NIL

12. **Course No. 12: Hands on training for advanced Laboratory techniques for ETT and embryo preservation**.- **(AEA -302)Credit - (0+ 2)**

Theory: NIL

Practical: Importance of bio-security measures to be adopted during ETT and AI. Standard operating procedure (SOP) to follow during and after the ETT process. Preparation of animals for ETT, process of epidural anesthesia and securing the animals in modern Travis. Palpation and scanning of female reproductive organ using ultrasonography. Evaluation and grading of embryos for transfer and preservation.

SEMESTER II

Foundation: Gap assessment in management at village level through PRA and assistance.
The candidates will be required to identify the gaps in the adoption of the technology at their attached units/farmers through questionnaire. The candidates will be provided questionnaire sheets which they will be required to fill, based on knowledge and skills acquired in semester-I. The sheet will address following questions for gap assessment:

1. Awareness of the locals regarding the AI & ETT .
2. List of breeds available of desi cow, buffalo and veterinary facility for treatment.
3. List of AI worker for AI and veterinary service.
4. List of medicine which they use for animal treatment.
5. Report preparation after gap analysis on all topics in the course.

Basic: Foundation + Problems in adoption and options to overcome under different social groups.
The candidates pursuing basic course will be required to identify the problems in AI adoption, repeat breeding problem. In addition to the aspects addressed by the foundation course questionnaire sheet, they will address following additional aspects:

1. Identification of problems in adoption of AI/ETT.
2. Suggestions for creating awareness among the local population about AI and ETT.

Advanced: Basic +
A. Dynamics of: Input – Yield – Economics
2.Laws regarding the activities, if any
The candidates pursuing advanced courses will address following aspects in addition to the aspects addressed by the foundation and basic courses:

1. The minimum standards for AI practice/ ETT laboratory.
2. Assessment of economics for the production of embryo and their feasibility.
3. Identification of the supply chain and their shortcomings.

Practical Skill Acquired with Stepwise assessment
The candidates will be assessed for the practical skills acquired according to the job responsibilities assigned to them as follows:

S. No.	Course	Job responsibilities
1.	Foundation	AI, detection of heat, Record keeping of animal and vaccination.
2.	Basic	SOP for AI/ETT preparation of animal for ETT, anesthesia and assistance during collection / flushing of embryo. Pregnancy Diagnosis after 60 days.
3.	Advanced	Laboratory Maintenance, Procurement and maintenance of all laboratory items, maintenance of all equipment after use. Embryo searching and keeping of record, Pregnancy diagnosis after 60 days.

LIST OF INFRASTRUCTURES REQUIRED FOR THE ESTABLISHMENT OF AI/ETT Laboratory

S. NO.	Rooms	Specifications
1.	Class Room for a batch 20	400 square feet area.
2.	Laboratory	A laboratory having minimum 500 square feet area for practical. The laboratory should have facility to store reproductive organs, keep different models of animals and reproductive organs.
3.	Teaching aids	• Adequate chair and table for trainee.(40) • White board • LCD projector • Computer-2 • Charts and Models • The centre must have required quantity of semen doses and LN(Liquid Nitrogen) storage container. • Reproductive organ must be obtained from near by slaughter house for palpation and passing of AI/ETT Gun.
4.	Animal housing facility for practical classes	For practice the centre should have minimum one animal for six students
5.	Smart classroom	One with the seating arrangement of 20 students and digital podium
6.	Animal shed	Two modern Trevis / an AI crate.
7.	Office chamber 15'X 12'	One
8.	Continuous electric supply	-

LIST OF EQUIPMENTS REQUIRED FOR THE ESTABLISHMENT OF AI/ ETT lab

S. NO.	EQUIPMENT	QUANTITY
1.	Autoclave	**1**
2.	Liquid Nitrogen Container (10 liter)	**5**
3.	Laminar Air flow single user	**1**
4.	Hot Air oven	**1**
5.	Double water Distillation Apparatus	**1**
6.	Electronic Balance single pan	**2**
7.	pH meter	**1**
8.	Trevis/ an AI crate	**2**
9.	Good quality Microscope (phase contrast)	**2**
10.	Magnetic stirrer with hot plate	**1**
11.	Refrigerator 300 L	**2**
12.	Air conditioner (1.5 ton)	**4**
13.	Centrifuge machine	**1**
14.	Voltage stabilizer 2.4 KVA	**1**
15.	Gumboot for students/ faculty	**12**
16.	AI Gun	**12**
17.	ETT gun	**6**
18.	I-VET Scope	**2**
19.	Cervix dilator	**5**
20.	Media as per need	
21.	AV set (Artificial Vagina)	**20**
22.	Bull mounting Mat	**4**
23.	Falcon tubes (10 ml, 5 ml, 2 ml,)	**100 each**
24.	Phantom box	**1**
25.	Bottles and tubes washing machine	**1**
26.	Pass box	**2**

LIST OF MISCELLANEOUS ITEMS AND CONSUMABLES FOR THE ESTABLISHMENT OFAI/ETT LAB

S. NO.	ITEM	APPROX COST (INR)
1.	Chemicals	**5, 00, 000**
2.	Media for culture	**1,00,000**
3.	Culture plates (Petridis)	**50000**
4.	Reagent Bottles (100 ml, 250 ml, 500 ml, 1000 ml)	**25,000**
5.	Conical Flasks (100 ml, 250 ml, 500 ml, 1000 ml, 2000 ml)	**25,000**
6.	Gloves (AI) and disposable	**25000**
7.	Glass rod Spatula Long forcep Scalpel Spirit lamp pH paper Wash Bottles Container for storage of Distilled water Test tube racks Test tube Baskets Dropper Tube cleaning brush Scissor Labelling sticker Blotting paper Tissue roll Gloves and mask Beaker tongs Aluminium foil Butter paper Hand sanitizer water container 5 litre	**2,00, 000**
8.	Glass Pipette (5 ml, 10 ml)	**10, 000**
9.	Beaker (25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml, 2000 ml)	**25, 000**
10.	Volumetric Flask ((100 ml, 250 ml, 500 ml, 1000 ml))	**25, 000**
11.	Measuring cylinder (10 ml, 25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml)	**25, 000**
12.	Micropipette (2 µl, 10 µl, 20 µl, 100 µl, 200 µl, 1000 µl) along with tips	**1,00000**
TOTAL		**11,10,000**

Annexure-6

CERTIFICATE COURSE

on

Sugarcane Cultivation Assistant*
Syllabus

SUBMITTED BY

SUGARCANE RESEARCH INSTITUTE
Dr. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY
PUSA, SAMASTIPUR, BIHAR – 848 125

***Proposal for Change of Course name under consideration**

Programme

Certificate Course on Sugarcane Cultivation Assistant

Background

Sugarcane refers to several species and hybrids of tall perennial grass in the genus *Saccharum*, tribe Andropogoneae, which are used for sugar production. This is the main source of sugar in India and holds a prominent position as a cash crop. India is the 2nd largest producer of sugar in the world after Brazil. Sugarcane is a renewable, natural agricultural resource because it provides sugar, besides biofuel, fibre, fertilizer and several byproducts/co-products with ecological sustainability. Its juice is used for making white sugar, khandsari and jaggery (gur). It is one of the main crop of earning foreign exchange. The main byproducts of the sugarcane industry are bagasse, pressmud and molasses. Bagasse is mainly used as a fuel. It is also used for the production of compressed fiber board, paper, plastics and furfural. Molasses is used in distilleries for the manufacture of ethyl alcohol, butyl alcohol, citric acid etc. Sugarcane press mud has good potential as organic fertilizer. Green tops of cane are a good source of fodder for cattle. Sugar industry in India is next in importance only to the textile industry and provides gainful employment to a large number of people, which impact the livelihood of about 5 crore farmers and their family members, and 5 lakh workers that are directly employed with the mills. There are 704 installed sugar factories,out of which 503 are operating in the countries during 2020-21 with production of 277.57 lakh tonnes of sugar till 31st March 2021 as against 233.14 lakh tonnes produced last year by 31st March 2020, *i.e* higher by about 44.43 lakh tonnes. The domestic demand of sugar is rotating around 22-23 million tonnes annually, whereas the production of sugar in India during last 5 years is twiddling around 24.3 to 26.3 million tonnes. Brazil has the highest export volume of sugar of any country, at 32.15 milliontonnes as of 2020-202. Sugarcane contributes about 80% of the total world sugar requirement while the remaining 20% came from sugar beet. In order to meet the per capita requirement of 35 kg sugar per year, India would need to produce 415 million tonnes of sugarcane having a sugar recovery 11% and cane productivity of 100 t/ha.

Cultivation of sugarcane is entirely different from other crops. Sugarcane takes about 9-18 months to harvest, depending on the climate. There is one harvest of the primary crop, and then 2-3 harvests of the ratoon. Ratooning is raising a crop with regrowth of the buds left over in the underground stubbles, germinate and give rise to another crop, referred as a ratoon. Sugarcane is propagated primarily through sett cuttings. The portion of the stalk of immature canes used for planting are known as seed cane, or cane setts, and have two or more buds (eyes), usually three. In general

February - March is the period of planting and December to March is the period of harvesting. In some states sugarcane is grown round the year. As sugarcane is planted at adequate row spacing and this inter-row space remains vacant during early growth stages extending nearly 3-4 months. Suitable short duration crops may be grown as intercrop that increases total productivity, higher monitory return,greater resource utilization and fulfils the diversified needs of the farmers. Intercropping also reduce the infestation by weeds and its severe competition to sugarcane crops for light, water, space and nutrients. A number of crops as intercrops in sugarcane have been tested at state and national level institute for better yield and sustainability in farmer's field. In autumn planted sugarcane, potato *(Solanumtuberosum*L.*)*, wheat *(Triticumaestivum*L.*)*, lentil *(Lens esculenta*Moench.*)*,rajmash*(Phaseolus vulgaris* L.*)*, garlic *(Allium sativum*L.*)*, coriander (*Coriandrumsativum*L.*)* and nigella *(Nigella sativa* L.*)* were found most suitable intercrops. However, in spring planted sugarcane, green gram (*Vignaradiata*L. Wilczek.*)*, black gram (*Vignamungo*L. Hepper) and lady's finger *(Abelmoschusesculentus*L. Moench*)* can be grown as inter crops.

Sugarcane and its derivatives have several known health benefits when consumed in moderate quantities. Chewing on sugarcane or consuming sugarcane syrup can help to treat urinary tract issues and provide a boost of antioxidants, along with providing benefits to pregnant women and diabetic patients. Sugarcane juice profit ranges from Rs. 3,000 to Rs. 5,000 per day in the summer season. Farmers are easily earning 8-10 lakhs per acre in a year. The key stakeholders of sugar industry, that is farmers, millers, consumers and the government have shared goals of achieving high economic growth, minimizing risks, enhancing farmer miller relationships, meeting growing domestic demand and contributing to the nation's food and energy needs. The industry provides employment to about two million skilled and non-skilled workers and other employed in ancillary activities mostly in the rural areas.

The demand for technically qualified manpower to manage different aspects of sugarcane production and processing technologies such as sugarcane breeding, seed production and protection technology, sugarcane chemistry, sugar &gur making technologies and mechanization in sugarcane cultivation are the urgent requirement of sugar industry. The above developments have put a lot of demands for skilled manpower equipped adequately to manage the sugarcane cultivation with a modern scientific technology. In our country there is no any certificate course on this vital issue related to sugarcane production and processing technology. As in view of changing market scenario, consumers' preferences and global competitiveness, new income-generating opportunities need to be created through crop and product diversification in sugarcane **'Produce to Product Chain'**. The sustainable sugarcane farming intended to meet society's sweeteners, food, energy and bio-fuel needs in the present

without compromising the ability of future generations to meet their own needs. Practitioners of sustainable sugarcane farming seek to integrate three main objectives into their work: a healthy environment, economic profitability, and social and economic equity. Every person involved in the food system-growers, sugar industry, food processors, distributors, retailers, consumers, and waste managers can play a role in ensuring a sustainable cane farming system.

Realizing the importance of trained manpower in the sugarcane industrial sector, Sugarcane Research Institute, RPCAU, Pusa, Samastipur, Bihar has proposed a one–year certificate course.

Certificate Course on Sugarcane Production Assistant (SPA)

This course will provide an introduction to the key principles and activities related to the sugarcane production and processing with modern technique. It will address all aspects of sugarcane production and processing technologies,

The major area of study in this programme includes:

- Basics of sugarcane cultivation
- Management of different aspects of sugarcane production system
- Monitoring of different protection aspects under sugarcane cultivation
- Ratoon management
- Sugarcane seed production
- Post-harvest management
- Processing of sugarcane for sugar/ jaggery making

About the Course

The objective of the course is to create a pool of sugarcane professionals with capacity to manage sugarcane cultivation efficiently in field and their post-harvest management. It addresses the crop production and protection aspects of cane cultivation. In addition the student will be got an exposure to the related sugarcane industries.

Course Structure and Contents

The duration of the course will be one year consisting of two semesters. Three certificate courses will be offered as per the qualification of the candidates. The course will cover theory and practical classes, both in the form of project and industry/Institute/ KVKs training along with assignments for each subject.

List of certificate programme

Sl. No.	Courses	Eligibility	Credit Hrs		
			Semester- I	**Semester- II**	**Total**
1	**Foundation**	8th Pass	20	28	48
2	**Basic**	10th Pass	24 (20 + 4)	28	52
3	**Advanced**	12th Pass	28 (24 + 4)	28	56

SEMESTER- I

The candidates will be offered courses in the first semester to provide them knowledge of the basic understanding of the course. The list of the courses offered under different programme is given below:

List of courses offered:

1. **Foundation courses: Total credit hrs: 20 (15 + 5)**

Course Sl. No.	Course Code	Course Title	Credit Hrs.
1	**SPA 101**	Introductory Sugarcane	2 (2 + 0)
2	**SPA 102**	Sugarcane Production	3 (2 + 1)
3	**SPA 103**	Sugarcane Nutrition	3 (2 + 1)
4	**SPA 104**	Sugarcane Protection	3 (2 + 1)
5	**SPA 105**	Sugarcane Water Management	2 (1 + 1)
6	**SPA 106**	Sugarcane Weed Management	2 (1 + 1)

2. **Basic courses (Foundation course- 20 + extra courses- 4) – Total credit hrs : 24 (17 + 7)**

7	**SPA 201**	Mechanization in Sugarcane cultivation	2 (1+1)
8	**SPA 202**	Sugarcane Chemistry, Sugar and Gur Technology	2 (1+1)

3. **Advance course (Basic- 24 + extra courses 4) Total credit hrs: 28 (19 + 9)**

9	**SPA 301**	Entrepreneurship in Sugarcane	2 (1+1)
10	**SPA 302**	Sugarcane Breeding, Genetics and Seed production	2 (1+1)

Semester- II [Total credit hrs: 28 (0 + 28)]

The courses of second semester will consist of practical classes, in the form of project and industry/Institute/ KVKs/entrepreneurs where the candidates will be given exposure to the Sugarcane Production and Processing Technology followingparameters along with assignments for each subject:

Name of the Courses	Credits	Weightage
Sugarcane Industrial Work Experience (SIWE) Programme: Class participation & assignment	14(0+14)	20 marks* (KVK/ Sugar industry)
Practical skill acquired with stepwise assessment	14(0+14)	20 marks (10 marks KVK/ sugar industry, 10 marks attached unit)
Attendance	**-**	**10 marks**
Practical Examination	**-**	**50 marks**

***The assignment will cover the following aspects for each course:**

A- Foundation course: Gap assessment in management at farmers' level through PRA and assistance.
B- Basic: Foundation + problems in adoption and option to overcome under different socioeconomic groups.
C-Advanced: Basic +

1. Dynamics of : Input- Yield – Economics
2. Laws regarding the activities, if any

SEMESTER II, [Total credit hrs: 28 (0 + 28)]

1. **Foundation: Gap assessment in management at village level through PRA and assistance.**

The candidates will be required to identify the gaps in the adoption of the technology at their attached units. The candidates will be provided assessment sheets which they will be required to complete. The sheet will address following questions for gap assessment:

1. Awareness of the locals regarding the technology.
2. List of seeds/settlings requiring for sugarcane production in this region.
3. List of equipments for sugarcane production, harvesting and processing.
4. List of chemicals, water soluble fertilizers, organic manures required for sugarcane production.

2. **Basic: Foundation + Problems in adoption and options to overcome under different social groups.**

The candidates pursuing basic course will be required to identify the problems in commercial applications of sugarcane production techniques and suggest the possible solutions. In addition to the aspects addressed by the foundation course assessment sheet, they will address following additional aspects:

1. Identification of limitations in commercial sugarcane production.
2. Suggestions for creating awareness among the local populations for Modern field preparation, planting methods and production technology of value added sugarcane

products, mechanization in sugarcane cultivation, sugarcane chemistry, sugar and gur technology.

3. Advanced: Basic + 1. Dynamics of: Input – Yield – Economics and 2. Laws regarding the activities, if any

The candidates pursuing advanced courses will address following aspects in addition to the aspect addressed by the foundation and basic courses:

1. The minimum standards and knowledge for the entrepreneurship in sugarcane.
2. Assessment of economics for the sugarcane production.
3. Identification of the supply chain other than sugar factory.

4. Practical Skill Acquired with Stepwise Assessment:

The candidates will be assessed for the practical skills acquired according to the job responsibilities assigned to them as follows:

S.No.	Course	Job responsibilities
1.	Foundation	Production technologies of sugarcane, intercropping, high value products of sugarcane
2.	Basic	Identification of limitations in commercial sugarcane production. Suggestions for creating awareness among the local populations for Modern field preparation, planting methods and production technology of value added sugarcane products, mechanization in sugarcane cultivation, sugarcane chemistry, sugar and gur technology
3.	Advanced	The minimum standards and knowledge for the entrepreneurship in sugarcane. Assessment of economics for the sugarcane production.Identification of the supply chain other than sugar factor.

LIST OF INFRASTRUCTURES REQUIRED

S.No.	Particulars/ Items	Specifications	Expected budget (lakh)
1.	Construction of Building for classroom and hostel	Modular Laboratory	
2.	Smart class room	One: the seating arrangement of 20 students and digital podium	
3.	Chair with desk		
4.	Hanging Projector		
5.	Revolving chair		
6.	Computer set, Printer with all accessories		
7.	Digital Camera		

LIST OF EQUIPMENTS AND CHEMICALS REQUIRED

SI.No.	EQUIPMENT/CHEMICALS	QUANTITY	EXPECTED BUDGET(LAKH)
1.	Pro trays/ plug tray	200	0.20
2.	Root Trainers	200	0.20
3.	Soil- less media (Co-co pit, vermiculite, perlite)	-	1.00
4.	Spade, hoeing rake, secateurs, budding knife etc	20 each	2.00
5.	Manure and fertilizers	-	1.50
6.	Insecticides and fungicides	-	0.30
7.	Seeds/seedlings of value added sugarcane products	-	2.00
8.	Irrigation loose pipe/ Garden pipe (Plastic)	-	0.20
9.	Power operated sprayer	1	0.25
10.	Electronic Balance single pan	1	0.20
11.	pH meter	1	0.25
12.	EC meter	1	0.25
13.	Humidifier	2	0.10
14.	Poly bags (perforated) for handlings of seedlings	5000	0.30
15.	Formaldehyde fumigants chemical	10 lit.	0.10
16.	Hand refracto meter/ Brix meter	10	0.25
17.	Chlorophyll meter	2	
18.	Portable IMR	1	
19.	Sucrolyser	1	8.5
20.	Baggase digester	1	
21.	Kelplus digestion and distillation	1	4.5
22.	Double Beam UV-VIS Spectrophotometer	1	0.78
23.	Flame photomtere	1	0.40
24.	Atomic absorption spectrophotometer	1	12.0
Total		-	

Eligibility Criteria for enrolment

1. 8^{th}Pass, 10^{th} Pass and 12^{th} Pass
2. The certificate must be from any recognized Indian Council/Board
3. The certificate must be from any Indian Council/Board incorporated by an Act of Central or State Legislature in India or other educational institution established by an Act of Parliament.

COURSE DETAILED
SEMESTER- I

1. Foundation Course – 20 (15+ 5) Cr. Hrs.

1. SPA 101: Introductory Sugarcane: 2 (2 + 0)

Theory:

History and distribution, Sugar producing plants. Crop rotation: Principles and advantages. Intercropping: Principles, types and advantages. Sugarcane &Sugar beet: Importance, brief idea on cultivation, origin..Major sugarcane producing countries in the world. Area under sugarcane cultivation in different states in India.

Practical: Nil

2. **SPA 102: Sugarcane Production**: 3 (2 + 1)

Theory: Soil, climate, land preparation, time and method of planting, planting geometry, seed cane, varieties, fertilizer application, inter-culturing, irrigation. earthing-up, propping, sugarcane based intercropping system, ratoon management, plant protection measures followed.

Practical: Identification of farm implements, visit of sugarcane farm, sett treatment, soil treatment, application of organic manures and chemical fertilizersat field level.

3. **SPA 103**: **Sugarcane Nutrition:** 3 (2 + 1)

Theory: Soils: Definition, classification, weathering and soil formation, Components of soil, soil properties, soil profile, soil organic matter, major (macro) and micronutrients and their deficiency symptoms and remedies. Concept of nutrients supplementation in sugarcane, manures and fertilizers, commercial fertilizers, bio-fertilizers.

Practical: Soil sampling, soil testing, determination of pH., E.C., organic carbon, and available N, P and K, preparation of different types of compost

4. **SPA 104: Sugarcane Protection** 3 (2 + 1)

Theory: Categories of sugarcane pest and disease, plant protection measures for sugarcane, major pest and diseases of sugarcane and their management, concept of IPM, scope and limitations. Biological control of pest and diseases. Classification of pesticide, mode of action and nature of chemicals, importance of chemical control, hazard and limitation, symptom of poisoning, first aid treatment and safe use of pesticides

Practical: Identification of important pest and diseases, use and application of important pest and disease control equipment. Factors affecting incidence of disease and pest infestation, application technique of spray fluids, insecticide formulation, and calculation of doses.

5. **SPA 105: Sugarcane Water Management** : 2 (1 + 1)

Theory: Irrigation, major advantage and adverse effect of excess irrigation, method of irrigation, drainage, irrigation scheduling. Factors affecting irrigation schedule, soil moisture measurement methods, elementary idea of infiltration, percolation, permeability, drainage, runoff and its role in sugarcane production.

Practical: water use efficiency, irrigation water use efficiency, identification and application of different irrigation measurement device,

6. **SPA 106: Sugarcane Weed Management** : 2 (1 + 1)

Theory: Common weeds, classification, losses and benefits, crop-weed association and competition, method of weed management, classification and mode of action of herbicide, selectivity ofherbicides.

Practical: Identification of common weeds. Weedicide formulation and calculation of doses.

2. Basic Course – 04 Cr. Hrs.

7. **SPA201: Mechanization in Sugarcane Cultivation : 2 (1+ 1)**

Theory: Objectives of farm mechanization, Introduction of various farm machine, Tillage-primary and secondary tillage equipment, field capacity and field efficiency measurement, sugarcane planting equipments, plant protection equipments, weeding equipments, repair and maintenance of equipment used in sugarcane production and processing. Introduction of various types of sugarcane harvester, construction details, material and working.

Practical: Introduction to various farm machines,Adjustment and working of MB plough, disc plough and disc harrow and secondary tillage tools.Measurement of field capacity and field efficiency, calibration of equipments, practice of hitching, adjustment and field operation of farm machinery.

8. **SPA 202: Sugarcane Chemistry, Sugar & Jaggery Technology : 2 (1+1)**

Theory:

General idea about sugar factories, their capacities and type of sugars produced, Flow diagram of process of white sugar, calculations for determining pol percent cane, bagasse per cent cane, Java Ratio, DMF and Fibre percent cane. General idea about theby-product of the sugar Industry and their utilization for value addition .Apparent and true purity, refractrometric and hydrometric brix, effect of dextron on sugar estimation and on processing, removal of dextron, colouring bodies present in sugar cane juice, determination of colour value of sugar cane juice, effect of staling of cane on processing. Introduction to the machinery used in jaggery

processing. Preparation of value added jaggery, packaging & storage and sugarcane juice, vinegar..

Practical: Determination of maturity of Sugarcane using cane puncturing needle and Hand Refractometer, Brix, Pol, Purity determination of Cane Juice, Reducing sugar estimation. Brix survey of sugarcane, Determination of Pol in Cane and Fiber percent in Cane. Determination of Extraneous matter in Cane, Determination of pH & Titratable acidity in Cane Juice. Preparation and quality evaluation of jaggery, method of determining adulteration in jaggery.

3. Advance course – 04 Cr. Hrs.

9. SPA 301: Entrepreneurship in Sugarcane : 2 (1+ 1)

Theory: Entrepreneurship: Concepts and function, concept of market, business finance and arithmetic, resource mobilization, entrepreneurial Opportunity, enterprise planning, negotiation, customer relationship management, secondary market, features and importance, Enterprise growth strategies

Practical: Estimating financial resources requirement; size and capital – based classification

10. SPA 302: Sugarcane Breeding, Genetics & Seed production : 2 (1+1)

Theory: Genetics of sugarcane, cultivated species, sugarcane varietal improvement, achievements, breeding objectives, nobilization, hybridization, clonal selection, commercial varieties, biotic and abiotic stresses, flowering behavior of varieties, seed cane, classes of seed, seed cane production, seed act, seed standard, criteria of selection of good quality sugarcane seed.

Practical: Preparation of sugarcane seed nursery, flowering behaviour,DUS characterization of sugarcane varieties.

Advisor	**Navnit Kumar**
Associated Scientist	**Ajeet Kumar**
Associated Scientist	**Balwant Kumar**
Associated Scientist	**Anupam Amitabh**

Annexure-7

CERTIFICATE COURSE FOR

"SEED PRODUCTION ASSISTANT"

Syllabus

DR. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY,
PUSA, SAMASTIPUR, BIHAR

Certificate Course on "Seed Production Assistant"

Introduction

Government of India has currently given much emphasis on entrepreneur development and Skill development with the objective to provide more job opportunities along with enhancing work efficiency. Lots of course are running for entrepreneurship and skill development in different sector economical activities for graduate students. Rural to sub-rural India is dominated by population with semi literate to literate youth whose mostly depends directly or indirectly on agricultural and allied activities for securing their livelihood. Skilling of these semi literate to literate youth in different aspects of agriculture and its allied activities is still a challenge task. The seed production and its allied activities has ample scope in making availability of quality seed to farming community at right time and right place is still has a long way to go in many states of India including Bihar. Bihar economy is mostly depends on agriculture and its allied activities still there is completely dearth of seed production activities resulted in its dependency on other states of country for majority of quality seed supply. Very few seed industry in private sector is working in Bihar, moreover there is huge availability of unskilled manpower who use to migrate to other states for their livelihood. If this section of rural youth gets an option to get trained them in different activities related to seed production and its associated business, this will definitely give economic boost to both rural and state economy.

Seed industry has a series of major activities starting from planning of seed production to its timely execution starting from seed sowing to its proper care for maintenance of different seed quality parameters; harvesting; seed drying; seed processing; seed storage and seed marketing. At every step of this chain, there are ample requirement of skilled man power. So, there is immense scopes for skilling these youth for these seed production and marketing series of activities. This skilled manpower will definitely help to boost economic activities of seed industry. Presently, due to absence of this skilled manpower, all these activities are basically performed by unskilled persons which enhance cost of seed production along with more chance of compromising with seed quality. Keeping these things in view, this certificate course is proposed for young youth with literacy from high school to intermediate pass, to skilled / trained them to perform specific work required to smooth functioning of current Seed business chain. This will benefit both seed industry and rural youth for securing their livelihood with dignity along with their contribute in country development. This Certificate Course on "Seed Production Assistant" is being proposed with following objectives:

a. to create skilled manpower among semi literate to literate rural youth for seed Industry.

b. to create job opportunity in seed production and allied activities along with making them able to start small repair and maintenance business for these equipment's of their own.

c. To impart training program to the students on various aspects of seed production, its quality maintenance, seed testing, processing & storage of seeds.

d. To build confidence through end to end approach in specific work of seed business.

Sl.	Course	Eligibility	Work type
01.	Foundation	8th Pass	Skilling in handling individual works, cleaning, maintenance & repairing; with other assistance
02.	Basic	10th Pass	Sl. 01 + Small official work such as records writing, operating of automatic machine, cleaning, maintenance and repairing of different equipment's
03.	Advance	12th Pass	02 + supervisory works of seed production such as keeping of all records, timely execution of different seed production and other activities; knowledge of

			work during monitoring of seed production and other official works.

COURSE STRUCTURE WITH WORK EXPERTISE DEVELOPMENT

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table -1)

Table 1: Qualification category wise credit load

Sl.	Course	Eligibility	Credit Hrs		
			Semester I	Semester II	Total
01.	Foundation	8th Pass	20	28	48
02.	Basic	10th Pass	24(20+4)	28	52
03.	Advance	12th Pass	28(24+4)	26	56

Theoretical and practical knowledge will be offered to the candidates in the first semester to provide them the basic understanding of the course. The list of courses offered under different programmers is given in table 2.

Table 2: List of courses offered

Foundation Course
Total credit hrs. : 20 (12+8)

Course No.	Course Code	Course Title	Credit Hrs.
1.	SPA 101	Pre-requisite basic course: introduction to agricultural activities	3(2+1)
2.	SPA 102	Introductory to seed technology	3(2+1)
3.	SPA 103	Seed Nursery management	2 (1+1)
4.	SPA 104	Handling of sowing/ transplanting equipment's used for major field crops	3 (1+2)
5.	SPA 105	Handling of major plant protection equipment's used for major field crops	1 (0+1)
6.	SPA 106	Handling of different seed harvesting equipment's used for major field crops	2 (0+2)
7.	SPA 107	Handling of seed processing activities	3 (1+2)
8.	SPA 108	Basic to Seed Sampling, principle, procedure, labeling of sample etc.	1(0+1)
9.	SPA 109	Basic of seed inspection and seed legislation	2 (2+0)

Basic courses [Foundation course (20) + extra course (4)]
Total credit hrs: 24(20+4)

10.	SPA 201	Seed production of major crops (varieties and hybrid)	2(1+1)
11.	SPA 202	Record keeping related to different seed production activities. Post-Harvest Handling and Storage of Seeds	1 (1+0)

12.	SPA 203	Seed Quality Testing	1 (0+1)

Advance [Basic (24) + extra course (4)]
Total credit hrs: 28 (24+04)

13.	SPA 301	Seed Industry and Marketing Management	1 (1+0)
14.	SPA 302	Seed Quality Enhancement	2 (0+2)
15.	SPA 303	Seed act and Seed legislation	1 (1+0)

The second semester will consist of KVK/ Seed Production Firms (Govt./Pvt,)/ Seed Industry/ Small Seed Business (village) /Laboratory attachment where the candidates will be given exposure to the commercial establishments covering following parameters:

Course/Students	Credit Hrs	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK, etc.)
Practical Skill Acquired with stepwise assessment	(0+14)	20 marks (10 marks KVK, etc. 10 marks by attached unit)
Attendance		10 marks
Practical Exam.		50 marks

***The assignments will cover the following aspects for each course:**

A.	Foundation	Gap assessment in handling of different activities in established private seed enterprises to small seed enterprises at village level/ Government seed enterprises to established private seed enterprisesthrough PRA and stepwise assessment required with analysis of data.
B.	Basic	Foundation + Problems in adoption and options to overcome under different size of seed business.
C.	Advanced	Gap assessment in management of established private seed enterprises to small seed enterprises at village level/ Government seed enterprises to established private seed enterprises through PRA and stepwise assessment required with analysis of data.

DETAILED SYLLABUS
SEMESTER I

1.	**Course No. 1:**	**Pre-requisite basic course: introduction to agricultural activities:**	**SPA 101 (2+1)**

Theory: Agriculture, its branches and activities; Basic knowledge of crops, its types; types of season; soil, its type, major characteristics; fertilizer, its type, application; compost, its type; Agronomy of major field crops,Stages of growth of plants; irrigation, its method, types of application; role of different plant protection measures; important symptoms of crop stress etc.

Practical: Basic knowledge of basic small tools use in seed production; introduction of different methods of irrigation; plant protection equipments, etc.

2.	Course No. 2:	Introductory to seed technology:	SPA 102 (2+1)
Theory: Basic of Seed, types of seed, generationsystemofseedmultiplication-classesofseed, difference between seed production and & grain production, difference between quality seed and farmers saved seed, Importanceof quality seed,seedqualityconcept, factors responsible for seed quality deterioration and measure to check it. **Practical:** Identification of different factors responsible for seed deterioration, rouging, stages of crop for rouging, introduction to isolation and its types, practical aspect on difference between quality seed and farmers saved seed.			
3.	**Course No. 3**:	**Seed nursery management:**	**SPA 103 (1+1)**
Theory: Basic knowledge of nursery, its types, formation of nursery for different situation and crop, its management. **Practical:** Preparation of seed nursery for different crops such as in paddy namely dry seed, wet seed, Dapog, met type etc.			
4.	**Course No. 4:**	**Handling of sowing/ transplanting equipment's used for major field crops:**	**SPA 104 (1+2)**
eory: Different types of machines used for sowing of major crops: Seed Drill, Zero till drills, paddy transplanter, Raise bed planter, Strip bed planter, different types of weeder and hoes etc., its knowledge of using, cleaning, maintaining, small repairing etc. **actical:** Method for proper handling, cleaning, maintenance, repair; Calibration of different seed drills, its adjustment with different crop.			
5.	**Course No 5:**	**Introduction to major plant protection equipments used for major field crops:**	**SPA 105 (0+2)**
Practical: Different types of sprayer used for plant protection of major crops: Knapsack, Battery operated sprayer, Ghator sprayer, Power sprayer, Boom sprayer etc, its working principle, use, cleaning , maintenance, repairing, dilution of differ chemicals. Method for proper handling, cleaning, maintenance, repair.			
6.	**Course No 6:**	**Introduction to different seed harvesting equipments used for major field crops:**	**SPA 106 (0+2)**
Practical: Harvesting of seed crops in relation of variety and hybrid, Mechanized Harvesting of seed crop, Basic Knowledge about working principle of different machine, its cleaning, maintenance, etc.			
7.	**Course No 7:**	**Know seed processing activities:**	**SPA 107 (1+2)**
Theory: Seed Processing, Basic principle of different seed processing equipments such as Scalper/ Pre cleaner. Seed grader namely screen grader (size), Indented cylinder (shape); Gravity separator (sp. Gravity); Color sortex (refracting index) etc. Seed theater (Mist-o-Matic); Automatic seed bag filling and stitching machine, their maintenance. Seed treatment, its principle, method etc. **Practical:** Method for proper handling, cleaning, maintenance, repair.			
8.	**Course No. 8:**	**Seed Sampling, principle, methods.**	**SPA 108 (0+1)**
Practical: Seed Sampling,Basic principle procedure, tools use, labeling of sample etc.			

9.	**Course No. 9:**	**Basic of seed inspection and seed legislation:**	**SPA 109 (1+1)**
Theory: Basic information about schedule of different inspections made by seed inspector and other SeedLegislation officials: preparation forcrop field for inspection, labeling of seed production plots, maintaining rouging. Measures taken during inspection of seed processing plants, seed godown, threshing floor etc. Knowledge of construction of seed lot number; types of seed tags, its specifications and labels. **Practical:**Rouging of crop at specific stage of crop growth, Seed production plot labelling; Tags, identification, its labelling.			
10.	**Course No. 10**	**Seed production of major crops (varieties and hybrid):**	**SPA 201 (1+1)**
Theory: Seed production principles of majorCereals,Pulses, Oilseed, Millets, Foggage crops, Tuber crops and Seed Spices crops. **Practical:** Identification of specific crops, knowledge of specific seed production activities related with crop.			
11.	**Course No. 11:**	**Post-Harvest Handling and Storage of Seeds.**	**SPA 202 (1+0)**
Theory: Seed treatment - methods - pre and mid storage seed treatments, seed treating formulationsand equipment's; packaging materials - types - bagging and labeling; seed blending - principle andmethods. Seed storage - purpose and importance - factors affecting storage, optimum condition forstorageofdifferentseeds;storageprinciples-Harrington'sthumbrule-conceptsandsignificanceofmoistureequilibrium-maintenanceofsafeseedmoisture			
12.	**Course No. 12:**	**Seed Quality Testing:**	**SPA 203 (0+1)**
Practical: Seed testing – sampling and dividing methods, Determination of seed test weight and Physical purity analysis, Seed moisture estimation – methods and equipments, Conduct of seed germination test and seedling evaluation, Conduct of quick viability (Tetrazolium) test, conducting different seed health tests to identify bacteria, fungi and insects.			
13.	**Course No. 13:**	**Seed Industry and Marketing Management:**	**SPA 301 (1+0)**
Theory: Seed production and distribution systems in state and central government; seed supply chain systems - seed production and distribution - planning, organization and coordination, staffing, assembling of resources; cost of seed production- overhead charges. Seed marketing - definition - importance - role of marketing; type of markets - domesticand global market - problems and perspectives; marketing policies - seed marketing schemes -marketingchannels, responsibilitiesof dealers-marketingmix.			
14.	**Course No. 14**	**Seed Quality Enhancement:**	**SPA 302 (0+2)**
Practical: practicing physical treatments and water floatation techniques, performing seed priming-hydro, halo and bio-priming-and microbial inoculation treatments, practicing pre-germination technique. Studying integrated seedtreatment			
15.	**Course No. 15**	**SeedAct and Seed legislation:**	**SPA 303 (1+0)**
Theory: Indian seed Act-1966, New Seed Policy-2002, Seed legislation.			

SEMESTER II			
1.	**A) Foundation:**	**Gap assessment in management at seed production enterprises (Govt. /Pvt,) through PRA and assistance.**	**SPA - 199**
The candidates will be required to handle the different seed production and allied activities at KVK/Govt. seed production firms/ Pvt. Seed production ventures and identify the gaps in the adoption of the technology at their attached units. The candidates will be provided assessment questionnaire; on this basis they will analyses gap based on information gathered. The sheet will address following questions for gap assessment 1. List of plant varieties more suitable in the region. 2. Study of the locals regarding need of seed industry. 3. List of equipment for seed industry establishment/strengthening.			
2.	**B) Basic:**	**Foundation + Problems in adoption of hybrid / variety seed production for major crops and option to overcome.**	**SPA - 299**
The candidates pursuing basic course will be required to identify the problems in commercial seed production of hybrid and variety in different crops; use of different machines/ equipment's in different steps of seed production venture, it's assessment, most probable reasons and suggestions the possible solutions. In addition to the aspects addressed by the foundation course assessment questionnaire, they will address following additional aspects. 1. Identification of problems in commercial exploitation hybris / variety seed production by the establishment. 2. Suggestion for creating awareness among the local populations about use of quality seed.			
3.	**C) Advance:**	**(a) Basic + Dynamics of: Input – Yield – Economics** **(b) Laws regarding the activity to be absorbed, if any**	**SPA - 399**
The candidate pursuing advanced course will address following aspects in addition to the aspects addressed by the foundation and basic candidates: 1. The minimum standards for the seed industry establishment. 2. Addition input based gap filling assessment for economics, based on information gathered. 3. Identification of the supply chain and their shortcomings.			

2. Practical Skill Acquired with Stepwise assessment.

Sl. No.	Course	Job responsibilities
01.	Foundation	Skilling in handling individual works, cleaning, maintenance & repairing; with other assistance
02.	Basic	Sl. 01 + Small official work such as records writing, operating of automatic machine, cleaning, maintenance and repairing of different equipment's
03.	Advance	Sl. 02 + supervisory works of seed production such as keeping of all records, timely execution of different seed production and other activities; knowledge of work during monitoring of seed production and other official works.

Annexure-8

CERTIFICATE COURSE

ON

FISH CULTURE ASSISTANT

Syllabus

COLLEGE OF FISHERIES, DHOLI, MUZAFFARPUR

Dr. RAJENDRA PRASAD CENTRAL AGRICULTURAL UNIVERSITY, PUSA (SAMASTIPUR) BIHAR

INTRODUCTION

The fish farming is an increasingly important rural activity in Bihar, supplying food and income for many households. Bihar has plentiful aquatic resources in terms of about 3,200 km of rivers, 100,000 hectares *chaurs* or floodplain wetlands, 9,000 hectares of oxbow lakes or *mauns*, 7,200 hectares of reservoirs and 69,000 hectares of ponds and tanks. There is an enormous potential for development of fisheries sector in the state, which is directly related to its rural economy. In the recent years, the government has paid important emphasis for development of this sector. Bihar has enough potential for diversification of aquaculture activities like introduction of freshwater prawn farming, culture of air-breathing fishes, integrated farming system, etc. The most commonly cultured fish species in the region are dominated by Indian major carp and Exotic carp which accounts almost 80% of the total aquaculture output. Aquaculture development will have a critical role in contributing to food demand. Reliance on a narrow range of species can increase the risk of failure (due to adverse climatic effects or attacks from diseases and pests, for example) in any primary production system. Increasing the range of species produced improves the security of the industry by broadening the opportunities for new markets. So, from the viewpoint of economic prosperity and aquaculture prospect, diversification of cultured species is positive to whole industry and should be the long-term aim to pursue.

The person trained in fish farming operation must deal with operation and control of all aspects of the fish production process, from pre-stocking management to post stocking management.

Moderately educated youth of the society can be trained and developed into skilled fish farming technician. This course focuses on providing hands-on capacity building of the students for learning the basics of fish farming and their management. The candidates completing this course can be employed as fish farm assistant and supervisor in farms, research institutes and industries. They will also become competent as service provider or establishing their own fish producing centre.

The **Major Objectives** of the programme will be:

a) To create skilled human resource in villages and towns to support fish farming led programmes of public and private sectors.

b) Enabling rural youths for providing services, establishing fish farm in rural areas to render services for maintenance of fish farming system.

c) To create employment opportunity for youth in the field of aquaculture.

The candidates completing this course will have job opportunities in following areas:

The area of work of fish culture assistant may be in fish farm as well as in service sector, besides growing as entrepreneurs. The important area of job opportunities of fish culture assistant will be in terms of

i. Wage employment

(a) Fish Farm Assistant
(b) Assistant to fish farm manager

ii. Self employment

(a) Fish Producer
(b) Consultancy to fish farmers
(c) Establishing fish culture farm

COURSE STRUCTURE

The duration of the course will be one year consisting of two semesters. Three categories of students can join this certificate courses as per the qualification of the candidates (Table 1).

Table 1: Qualification category wise credit load

S. No.	Course	Eligibility	Credit Hrs		
			Semester I	Semester II	Total
1.	Foundation	8th pass	20 (12+8)	28 (0+28)	48
2.	Basic	10th pass	24 (14+10)	28 (0+28)	52
3.	Advanced	12th pass	28 (16+12)	28 (0+28)	56

The candidates will be offered courses in the first semester to provide them knowledge of the basic understanding of the course. The list of courses offered under different programme is given in Table 2.

Table 2. List of courses offered

The first semester will consist of theory and practical classes as per the credit hours as follows:

SEMESTER-I

Foundation courses
Total credit hrs: 20 (12+8)

Course No.	Code	Course Title	Credit Hrs
1.	FCA 101	Introduction to Inland Aquaculture	1+1
2.	FCA 102	Soil & Water Quality Management	2+2
3.	FCA 103	Cultivable Fish Species in Inland waters	2+1
4.	FCA 104	Pond Aquaculture System	2+1
5.	FCA 105	Fish Nutrition and Feeding Management	2+1
6.	FCA 106	Integrated Aquafarming System	1+1
7.	FCA 107	Fish Disease Diagnosis, Therapeutics and Treatment	2+1

Basic courses [Foundation courses (20) + additional courses (4)]Total credit hrs: 24 (14+10)

8.	FCA 201	Pen & Cage Culture System	1+1
9.	FCA 202	Intensive Aquaculture Farming System	1+1

Advancedcourses [Basic courses(24) + additional courses (4)]
Total credit hrs: 28 (16+12)

10.	FCA 301	Pond Designing and Construction	1+1
11.	FCA 302	Organic Aquafarming	1+1

SEMESTER-II

The second semester will consist of Village /Laboratory /Farm attachment where the candidates will be given exposure to the commercial establishments/Farmers covering following parameters:

Course/Students	Credit Hrs	Weightage
Class Participation and assignments	(0+14)	20 marks * (KVK)
Practical Skill Acquired with Stepwise assessment	(0+14)	20 marks (10 marks KVK, 10 marks Attached Unit)
Attendance		10 marks
Practical Exam		50 marks

*The assignments will cover the following aspects for each course:

A. **Foundation** : Gap assessment in management at village level through PRA and stepwise assistance required.

B. **Basic** : Foundation + Problems in adoption and options to overcome under different pond size groups.

C. **Advanced** : Basic + 1. Dynamics of: Input – Yield – Economics.
2. Laws regarding the activities, if any.

DETAILED SYLLABUS

SEMESTER-I

Course No. 1	**Introduction to inland aquaculture: FCA 101 (1+1)**
Theory :	History of aquaculture, Basics of aquaculture. Different freshwater fish farming resources, Potential of inland water bodies of Bihar, Types of fish culture systems – Extensive, Semi-intensive and Intensive, Aquaculture Vs Agriculture
Practical:	Aquaculture resources of Bihar. Total freshwater aquaculture production statistics of Bihar. Identification of different freshwater aquaculture fish species. Growth studies in aquaculture.

Course No. 2	**Soil and Water Quality Management: FCA 102 (2+2)**
Theory :	Water chemistry: properties of fresh water. Optimum water quality parameters for aquaculture. Physical properties of soil; colour, texture, structure, pore size, bulk density, water holding capacity. Soil types and their distribution. Different chemicals for soil and water correction: lime, fertilizers, micronutrients, zeolites, alum, gypsum. Optimum soil quality parameters for aquaculture.
Practical:	Water analysis: measurement of temperature, turbidity, pH, DO and Free CO_2. Determination of total alkalinity, hardness, inorganic nitrogen, and phosphorus. Soil analysis: Determination of soil texture, soil pH, soil available nitrogen.

Course No. 3	**Cultivable fish and shellfish species in Inland Waters: FCA 103 (2+1)**
Theory :	Important criteria for selection of cultivable fish species, Traits and culture methods of important cultivable fish and shellfish and their culture methods – Indian major carps (Rohu, Catla, Mrigal), exotic carps (Silver carp, Grass carp, Common carp, Air breathing fishes (Pangassius, Magur, Singhi), Monosex tilapia, freshwater giant prawn.
Practical:	Workout of economics of different fish species farming, growth analysis of cultivable fish/ shellfish. Physical and biological parameters analysis for culture of different cultivable fishe/shellfish.

Course No. 4	**Pond aquaculture system: FCA 104 (2+1)**
Theory :	Types of fish ponds and their utilization. Criteria for selection of candidate species for freshwater aquaculture. Monoculture, polyculture and composite culture system, Pre-stocking, stocking and post stocking pond management: control of aquatic weeds and algal blooms, presatory and weed fishes, liming, fertilization/ manuring, use of biofertilizers, supplementary feeding,.
Practical:	Management of nursery, resaring and growout ponds; study on effects of liming, manuring and fertilization on water quality of fish pond. Collection and identification of aquatic weeds, insects and weed fishes. Quantitative study of plankton.

Course No. 5	**Fish nutrition and feeding management: FCA 105 (2+1)**
Theory :	Nutrition in fishes. Methods of feed formulation and manufacturing. Forms of feeds: wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets. Feed additives: binders, antioxidants, enzymes, pigments, growth promoters, feed stimulants. Feed storage: problems and solutions. Different feed evaluation parameters. Different feeding methods. Nonconventional feed ingredients and anti-nutritional factors. Digestive enzymes in feed. Major aqua feed manufacturers in India.
Practical:	Proximate composition analysis of feed ingredients and feeds. Preparation of artificial feeds using locally available feed ingredients. Determination of sinking rate and stability of feeds. Effect of storage on feed quality.

Course No. 6	**Integrated Aquafarming: FCA 106 (1+1)**
Theory :	Basis of integrated farming system, species of fish suitable for integrated farming, integration of aquaculture with agriculture, horticulture, livestock. Makhana-cum-fish culture, Water chestnut – cum- fish culture.
Practical:	Site selection for integrated farming system, Estimation of livestock requirement/unit in integrated aquaculture, designing of paddy plot for paddy-cum-fish culture, economics of different integrated farming system.

Course No. 7	**Fish Disease Diagnosis, Therapeutics and Treatment: FCA 107 (2+1)**
Theory :	Role of physical (injuries, health, cold) chemical (pH, ammonia, nitrogenous waste, endogenous chemicals and metabolites, free radicals, oxidants) soil and water parameters in fish health. Different types of fish diseases; parasitic, bacterial, fungal and viral. Nutritional diseases. Diagnosis, prevention and treatment of different type's diseases of fish. Probiotics, Best management practices.
Practical:	Examination of normal and diseased fish. Methods of sampling fish for disease diagnosis. Identification of disease causing agents. Different chemicals and medicines used for fish disease treatment.

Course No. 8	**Pen & Cage Culture System: FCA 201 (1+1)**
Theory :	Suitable water resources for pen and cage culture. Important materials required for pen and cage installation, Design, shape and size of pen and cage, Pen and cage frames and supporting system. Selection of fish species for pen and cage culture system. Post stocking measures required for pen and cage farming system, Feed and feeding methods in pen and cage aquaculture system, Advantages and disadvantages of pen and cage aquaculture over pond culture system.
Practical:	Survey of site for installation of pen and cage, selection of suitable fish species for pen and cage culture, selection of materials required for pen and cage construction.

Course No. 9	Intensive Aquaculture Farming System: FCA 202 (1+1)
Theory :	Principle of intensive fish farming, Components and methods of different intensive fish farming system – Re-circulatory aquaculture system (RAS), Biofloc technology, Aquaponics. Economics of intensive fish farming systems.
Practical:	Visit at different intensive fish farming system units; Different equipments involved in intensive aquafarming system – aerators, pumps and filters; Planktons and microbial analysis of biofloc.

Course No. 10	Pond Designing and Construction : FCA 301 (1+1)
Theory:	Selection of site for pond construction, Measurements and marking of land area, Calculation of area and volume required for different types of ponds, Dyke designing and construction, Dyke strengthening methods, Water control structures – inlet and outlet, sluice gate, monk, etc., Seepage and their control methods.
Practical:	Surveying of land for pond construction. Area and volume calculation by Simpsons and Trapezoidal methods. Calculation of different dyke slopes.

Course No. 11	Organic Aquafarming : FCA 302 (1+1)
Theory :	Present and future prospects of organic aquafarming. Principles of organic aquafarming, , Impact of organic farming on sustainability of water and soil productivity, Sources of organic fish feed ingredient, Good management practices for organic aquafarming, Advantages and disadvantages of organic aquafarming, Introduction about organic aquafarming certifying body.
Practical:	Drawing layout of an organic fish farm with biosecurity, Record keeping in organic aqua farming.

SEMESTER II

Fundamental

a) Practical skill acquired in fish culture

- ✓ Nursery, Rearing and Grow-out pond preparation
- ✓ Analysis of soil and water quality parameters
- ✓ Nursery rearing techniques
- ✓ Fingerlings/ Yearlings development of commercially important carps

b) Excursion tours/Exposure visits

PRA survey will help the students to know the different techniques of fish/shellfish culture, major hurdles facing by private/public fish farm managers. Visit to private/publicfish farm

- ✓ Visit to fish feed mills.
- ✓ Visit to fish farm.
- ✓ Visit to different government institutes engaged in fisheries activities like State FisheryDepartment, KVKs, ICAR Research institute etc.

Basic

- ✓ Fundamental + Problems in adoption and options to overcome under different fish farmingsystems.

Advanced

1. Basic + Detailed project report (DPR) preparation

- ✓ Students will learn how to prepare a DPR in area of specialization related to course:
- ✓ Organic aquafarming facility
- ✓ Construction of different fish farming unit as per targets.
- ✓ Establishment of fish farming unit of different stages

2. Assignments

3. Report writing and submission

1. Foundation Course: Gap assessment in management at village level through PRA and assistance:

The candidates are required to identify the gap in availability of fish production techniques at their village/farm. The assessment of gap between prevailing fish farming and proposed mechanization will be achieved by a survey to gather information through a questionnaire based on PRA.

2. Basic Course: Foundation course + problems in adoption & options to overcome under different fish farming systems.

The candidates pursuing basic course will be required to identify the problems and possible suggestions for addressing the foundation course assessment questionnaire.

3. Advance Course: Basic course + dynamics of input, yield, and economics.

The candidates pursuing advance course will addressed the following aspects:

- Estimation of economics of fish farming by basic course candidates.
- Estimation of total yield of fish.

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