Q. 1: Select an appropriate answer and tick mark (✓)

1. The process of bringing a wild species under human management is called
   (a) Acclimatization (b) Germplasm
   (c) Introduction (d) Domestication

2. The first artificial plant hybrid was produced by crossing of
   (a) Varieties of Tobacco (b) Species of Tobacco
   (c) Carnation and Sweet William (d) Varieties of pea

3. Johannsen proposed the pureline theory based on his work on
   (a) French bean (b) Sugarbeet
   (c) Lima bean (d) Sugarcane

4. The cross of F₁, with any parent is called
   (a) Top cross (b) Test cross
   (c) Back cross (d) Double cross

5. The pre-requisite for crop improvement is
   (a) Genetic variation (b) Sexual reproduction
   (c) Easy pollination control (d) CMS

6. Heterosis over commercial hybrid is known as
   (a) Heterobeltiosis (b) Standard heterosis
   (c) Mid-parent heterosis (d) Average heterosis

7. Mass selection is always based on
   (a) Genotypes (b) Phenotypes
   (c) Progeny test (d) Heritability

8. The concept of centres of origin of crop plants was proposed by
   (a) N. I. Vavilov (b) C. Linnaeus
   (c) J. R. Harlan (d) J. B. Hutchinson

9. Kalyan sona and Sonalika varieties of wheat were developed using
   introductions from CIMMYT through
   (a) Acclimatization (b) Hybridization
   (c) Mutagenesis (d) Selection
71. **Emasculation of flower is necessary for hybridization in**
   (a) Self incompatible plants  (b) Male sterile plants
   (c) Self pollinated plants  (d) Dioecious plants

72. **In true diploid species**
   (a) n = x  (b) n < x
   (c) n > x  (d) n ≠ x

73. **A breeding scheme provide maximum opportunity to utilize breeder's skill is**
   (a) Introduction  (b) Pedigree method
   (c) Mass selection  (d) Pure line selection

74. **Collection of germplasm within the country is called as**
   (a) Indigenous collection  (b) Indirect collection
   (c) Exotic collection  (d) Alien collection

75. **Bulk method of breeding is suitable for**
   (a) Fruit crops  (b) Vegetable crops
   (c) Small grain crops  (d) Flower crops

76. **Head quarter of International Potato Centre is**
   (a) Rome  (b) Peru
   (c) Mexico  (d) Nigeria

77. **Progeny of a single plant obtained by asexual reproduction is**
   (a) Pure line  (b) Inbred line
   (c) Clone  (d) Strain

78. **In apomixes, the progeny closely resembles to**
   (a) Male parent  (b) Female parent
   (c) Both male and Female  (d) None of the above

79. **Protogyny is found in case of**
   (a) Maize  (b) Bajra
   (c) Wheat  (d) Chick pea

80. **The quickest breeding method for development of variety is**
   (a) Introduction  (b) Pedigree method
   (c) Mass selection  (d) Bulk method
Agricultural Universities of Gujarat

1. Anand Agricultural University, Anand
2. Junagadh Agricultural University, Junagadh
3. Navsari Agricultural University, Navsari
4. S. D. Agricultural University, S.K. Nagar

Fourth (New/Old) Semester End Examination of B. Sc. (Hons.) Horti. (Suppl.) Dec.-2015-Jan.-2016

PART B: Subjective

<table>
<thead>
<tr>
<th>Course No.: FRT 4.10/4.4</th>
<th>Title of Course: Principles of Plant Breeding (2+1)</th>
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<tr>
<td>Date: 28-12-2015</td>
<td>Time: 10.15 to 12.00 hrs.</td>
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<tr>
<td>Day: Monday</td>
<td>Marks: 40.00</td>
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Q.1(A): Define/Explain the following terms (Any TEN) (5.00)

1. Plant Breeding
2. Domestication
3. Quarantine
4. Parthenogenesis
5. Gene pool
6. Mutation
7. Test cross
8. Dielny
9. Male sterility
10. Heterosis
11. Emasculation
12. Chasmogamy

Q.1(B): What is backcross? Describe the procedure to transfer recessive gene governing disease resistance into popular cultivated variety through backcross breeding. (5.00)

Q.2(A): Differentiate between the following (Any FIVE) (5.00)

1. Qualitative characters and Quantitative characters
2. Male sterility and Self-incompatibility
3. Heterosis and Inbreeding depression
4. Pedigree method and Backcross method
5. Synthetic variety and Composite variety
6. Autogamy and Allogamy

Q.2(B): Give scientific reasons for the following (Any FIVE) (5.00)

1. Farmers are advise to purchase fresh hybrid seed every year.
2. Triploids are always sterile.
3. GMS is not much more popular among plant breeders.
4. Maize is a cross pollinated crop.
5. Extensive yield trials are not required in back cross method of breeding.
6. Collection and maintenance of germplasm is necessary for plant breeders.

(PTO)
Q.3(A): Write short notes on the followings (Any TWO) (6.00)
1. Distant hybridization
2. Plant Introduction
3. Apomixis
4. Male Sterility

Q.3(B): Calculate the per cent relative heterosis, heterobeltiosis, economic heterosis and inbreeding depression using following yield data (kg/ha) of pigeonpea.
\[ P_1 = 800, \ P_2 = 1200, \ F_1 = 1600, \ F_2 = 1400 \text{ and Standard check} = 1500 \] (4.00)

Q.4: Do as directed. (Any TEN) (10.00)
1. Which are the undesirable effects of plant breeding?
2. What is mutagen? Give the classification of mutagen.
3. Enlist the characteristics of good multilines.
4. Write the requirements of a back cross breeding programme.
5. Enlist the techniques to overcome self incompatibility.
6. Draw a schematic diagram of megasporogenesis.
7. What do you understand by A, B and R lines?
8. What is hybridization? Give its types.
9. Enlist the mechanisms which promote self pollination.
10. Give the characteristics of clone.
11. Enlist the purpose of plant introduction.
12. Briefly explain the Hardy-Weinberg law.

***************
PART-A (OBJECTIVE)

Q.1  Tick mark (✓) most appropriate answer from the following multiple choice. (40.00)

1. Ring like scarred area encircling the citrus stalk and irregular mottled patches on rind is symptom of
   a. Thrips  
   b. Scale  
   c. Aphid  
   d. Whitefly

2. 400 gauge alkathene sheet fastened on the tree trunk and paste grease as well as methyl parathion dust on the band to prevent upward migration of nymphs of ...........
   a. Mealybug  
   b. Mite  
   c. Fruitfly  
   d. Whitefly

3. Which attractants use to attract Mango fruitfly
   a. Methyl eugenol  
   b. Trimedlure  
   c. Heptyl Butyrate  
   d. Cinnamaldehyde

4. The alternative host of Mango hopper is .......... 
   a. Guava  
   b. Citrus  
   c. Sapota  
   d. None of the above

5. As results of feeding and metabolic secretion by caterpillar of ............ form gall at the apical growing tip resembling “Snake chamber fluts” in aonla.
   a. Apical twig gall maker  
   b. Aonla fruit borer  
   c. Aonla leaf roller  
   d. Bark eating caterpillar

6. Grubs tunnel into trunks moving upward, feeding on internal tissue, when reached sapwood the attacked stem die
   a. Stone weevil  
   b. Black headed caterpillar  
   c. Stripped beetle  
   d. Stem borer

7. Female of Citrus butterfly lays eggs on/in
   a. Soil  
   b. On leaves  
   c. Root  
   d. Stem

8. Female laid 150-200 eggs just below epicarp of fruit infested fruits finally drop down. The fully developed larva has a jumping habit.
   a. Mango stone weevil  
   b. Mango stem borer  
   c. Mango fruitfly  
   d. Mango hopper
9. The adult weevil is reddish brown with six spots on thorax and a long curved snout and grub is stout, apodous and conical body bulged in the middle and tapering towards the ends.
   a. Rhinoceros beetle  
   b. Black headed caterpillar  
   c. Red palm weevil  
   d. Rodent

10. Scientific name of Mango leaf gall midge  
   a. *Proctocontarinia maidelana*  
   b. *Apsylla cistelata*  
   c. *Erosommyia indica*  
   d. *Chlamethia transversa*

11. Female laid eggs singly on the epicarp of partially developed fruit of mango, grubs bore through the pulp, feed on the seed coat and later damage cotyledons.
   a. Hopper  
   b. fruitfly  
   c. Stone weevil  
   d. Stem borer

12. What is the scientific name of Lemon butterfly  
   a. *Ophides fullonica*  
   b. *Papilio demoleus*  
   c. *Phyllonipsis citrella*  
   d. *Diaphorina citri*

13. Which insect pest of citrus, where only the adults are damaging stage.
   a. Citrus psylla  
   b. Whitefly  
   c. Lemon butterfly  
   d. Fruit sucking moth

14. ........ causes irritation during harvest and is a nuisance in Mango orchards.
   a. Mealbug  
   b. Whitefly  
   c. Red Ant  
   d. Stem borer

15. Trapping of attracted adult with psuedostem during nights to control which pest of banana.
   a. Aphid  
   b. Pseudostem weevil  
   c. Thrips  
   d. Rhizome weevil

   a. San Jose scale  
   b. Woolly aphid  
   c. Codling moth  
   d. Leaf curl aphid

17. Which pest of coconut, the adults are damaging stage and grubs feed on the decomposed organic matter.
   a. Red palm weevil  
   b. Black headed caterpillar  
   c. Rhinoceros beetle  
   d. Mite

18. Scientific name of coconut black headed caterpillar.
   a. *Tratthaba mundella*  
   b. *Aonidiella orientalis*  
   c. *Opisina arenosella*  
   d. *Bamisia tabaci*

19. Which pest of coconut damage directly on fruits longitudinal cracks develop on the surface and on gum exudes from the cracks.
   a. Rhinoceros beetle  
   b. Mite  
   c. Black headed caterpillar  
   d. Red palm weevil

20. The larva bores into the sapota fruit, enters the seed and feed on endosperm of seed.
   a. Bud borer  
   b. Chiku moth  
   c. Seed borer  
   d. Fruitfly

21. Major pest of cashew is.
   a. Tea mosquito bug  
   b. Apple nut borer  
   c. Thrips  
   d. Stem and root borer

22. Females of which pest cut transverse slits under the bark of girdled branch and thrust in between the bast and sap wood of grape vine.
   a. Flea beetle  
   b. Stem borer  
   c. Girdler beetle  
   d. Root borer

23. Site of pupation for Girdler beetle is.
   a. Inside the tunnel  
   b. Inside soil  
   c. Inside leaf midrib  
   d. On the stem
24 Which pest of citrus produces a toxic substances in the plant as a result of which the fruit remain under sized and poor in juice also responsible for spreading the greening virus.
  a. Citrus whitefly  b. Citrus psylla
  c. Citrus leaf miner  d. Lemon butterfly
25 Insect vector for Tristeza virus disease is
  a. Lemon butterfly  b. Citrus whitefly
  c. Citrus aphid  d. Citrus leaf miner
26 The female of red palm weevil lay eggs ...
  a. Inside the tunnel  b. In scoop out cavity of palm
  c. Inside leaf midrib  d. In soil
27 First instar larvae of .....is look like a bird dropping
  a. Citrus psylla  b. Citrus whitefly
  c. Lemon butterfly  d. Citrus leaf miner
28 .....popularly known as "violin beetle".
  a. Flea beetle  b. Mango stem borer
  c. Girdler beetle  d. Rhinoceros beetle
29 .....species of mango hopper are comparatively larger in size and have two round black spots on the anterior margin of pronotum.
  a. Amribodus atkinsont  b. Idioscopus nittidulas
  c. Idioscopus clypealis  d. Amribodus clypealis
30 Disease “citrus canker” is spread through .....agent
  a. Citrus psylla  b. Citrus whitefly
  c. Lemon butterfly  d. Citrus leaf miner
31 Moths are greenish to dark brown in colour with chocolate or copper coloured circular markings near the tip of the margins.....
  a. Apple codling moth  b. Fruit sucking moth
  c. Hellolithis  d. Spodoptera
32 A single female of.......... laid more than 100 eggs in spiral pattern on ventral side of citrus leaves.
  a. Citrus psylla  b. Citrus blackfly
  c. Lemon butterfly  d. Fruit sucking moth
33 Application of Beauveria bassiana to FYM pit kills the grubs of .......... pest.
  a. Flea beetle  b. Rhinoceros beetle
  c. Black headed caterpillar  d. Girdler beetle
34 The honey dew excreted by hoppers encourages the development of .......... which interferes with the photosynthetic activity of the plants.
  a. Black shooty mold  b. Fungus
  c. Bacterial canker  d. Virus
35 Banana aphid is a vector of ....disease
  a. Canker  b. Leaf curl
  c. Greening virus  d. Bunchy top
36 .......... are nocturnal in habit and lay eggs on number of wild plants and weeds, growing near citrus orchards.
  a. Citrus blackfly  b. Citrus whitefly
  c. Fruit sucking moth  d. Citrus psylla
37 'Black Tulai' + DDVP poison bait trap used to control which pest of Sapota.
  a. Bud borer  b. Fruitfly
  c. Leaf folder  d. Leaf miner
38 ‘Deep ploughing’ practices is carried out in mango orchard to expose .......... Stage of fruit fly.
   a. Pupa     b. Adult
   c. Eggs     d. Larva
39 Within 24 hours of hatching nymphs of ..........begin to secrete woolly material on its body.
   a. San Jose scale     b. Whitefly
   c. Blackfly     d. Apple woolly aphid
40 Mango fruit drop at marble sized due to attack of ____________
   a. Mango mealybug     b. Fruits fly
   c. Mango hopper     d. Stone weevil
41 Citrus leaf miner belongs to family
   a. Agromycidae     b. Gracillariidae
   c. Galuridae       d. Gelichidae
42 Larvae feed their own exuviae after each moulting in the case of ____________
   a. Fruit sucking moth     b. Both a and b
   c. Citrus butterfly     d. None of above
43 Citrus can be covered with perforated polythene bag to control the incidence of ____________
   a. Fruit sucking moth     b. Citrus butterfly
   c. Citrus psylla     d. None of above
44 The larvae of fruit fly is known as ____________
   a. Grub     b. Nymph
   c. Maggot     d. Both a and b
45 Maggots bore inside the leaf tissue and feed within, resulting in formation of small raised wart like galls on leaves
   a. Gall midge     b. Stem borer
   c. Fruit sucking moth     d. Bark eating caterpillar
46 Adult is large beautiful butterfly having creamy yellow colouration on the underside of abdomen
   a. Citrus blackfly     b. Leaf miner
   c. Fruit sucking moth     d. Lemon butterfly
47 Methyl eugenol is used as attractant against
   a. Oriental fruit fly     b. Carrot fly
   c. Melon fruit fly     d. Leaf miner
48 Bore holes, tunnels in the pseudostem, wilting of banana plant is due to
   a. Cosmopolites sordidus     b. Pericaria ricini
   c. Stephanthus typicus     d. Odoiporus longicollis
49 Scientific name of Banana aphid is ____________
   a. Pentalonia nigronevosa     b. Stephanthus typicus
   c. Aphis gossipy     d. Pericaria ricini
50 A serious pest of Citrus nursery
   a. Fruit sucking moth     b. Lemon butterfly
   c. Citrus blackfly     d. Citrus psylla
51 Lace wing bug belongs to family
   a. Miridae     b. Tingidae
   c. Coccidae     d. Corriedae
52. Tea mosquito bug does not feed on
   a. Sweet potato               b. Citrus
   c. Guava                     d. Tea
53. Infested pomegranate fruits ultimately fall off and give an offensive smell
   a. Conogethes pungitferalis  b. Helopeltis antonii
   c. Virachola isocrates      d. Bactrocera diversus
54. Scientific name of chickoo moth is ________.
   a. Virachola isocrates      b. Conogethes pungitferalis
   c. Nephopteryx eugraphellas  d. None of above
55. Predator used for controlling Cottony cushion scale ________.
   a. Rodalia cardinals         b. Xanthopla pumpacta
   c. Exacrodus popuans         d. Apanteles flavipes
56. Caterpillar is yellowish brown having a horn like structure on the dorsal site of last body
    segment
   a. Citrus blackfly          b. Citrus whitefly
   c. Fruit sucking moth       d. Lemon butterfly
57. Crinkling and yellowing of leaves and rotting of grape berries is due to
   a. Stem girdler              b. Mealybug
   c. Aphid                     d. Thrips
58. Scientific name of aonla fruit borer is ________.
   a. Meridarches scyrodus      b. Rhagoletis pomonella
   c. Cydia pomonella           d. Deudorix isocrates
59. The quarantine pest of apple is
   a. Codling moth              b. San jose scale
   c. Woolly aphid              d. Gypsy moth
60. Inter planting tomatoes with papaya for the control of
   a. Leaf miner                 b. Aphid
   c. Mealy bug                  d. Whitefly
61. Sowing of coriander and fenugreek as a border rows around papaya plantations for the
    control of
   a. Leaf miner                 b. Aphid
   c. Mealy bug                  d. Whitefly
62. Cover young developing fruits of jack fruit with perforated alkathene bags to prevent egg
    lying of ________.
   a. Shoot and fruit borer     b. Fruit sucking moth
   c. Mealy bug                 d. All of above
63. Application of persistent insecticides on the mango trunk during off season is control of______.
   a. Mango hopper              b. Fruitfly
   c. Mealybug                  d. Stem borer
64. ............... insecticide banned in India.
   a. Endosulfan                b. Fenthion
   c. Monocrotrophos            d. All of above
65. Hibernation is in the adult stage by hiding in cracks and crevices or in the bark of mango
    trees during October month.
   a. Mango hopper              b. Stem borer
   c. Mealybug                  d. Fruitfly
66 Moth punctures the ripening fruits of citrus for sucking juice
   a. Lemon butterfly
   b. Citrus whitefly
   c. Fruit sucking moth
   d. Citrus psylla

67 Fungus used to control rhinoceros beetle
   a. *Metarhizium anisopliae*
   b. *Hirsutella thompsonii*
   c. *Verticillium lecanii*
   d. *Nomuraea rileyi*

68 .......... is an aggregation pheromone used for control of red palm weevil.
   a. Methyl eugenol
   b. Cuelure
   c. Ferrolure
   d. Trimedlure

69 Alternate host of *Oryctes rhinoceros* .......... a. Pineapple
   b. Sugarcane
   c. Areca nut
   d. All of above

70 Root feeding technique is followed to control following pest
   a. Red palm weevil
   b. Black headed caterpillar
   c. Chiku moth
   d. All of above

71 Full grown larvae (8-10 mm long), transverse white coloured band between head and thorax
   and makes the hole on upper portion of sapota buds.
   a. Chiku moth
   b. Chiku bud borer
   c. Chiku margin folder
   d. Chiku seed borer

72 Site of egg laying of mango mealybug is......... a. Soil
   b. Leaf
   c. Seed
   d. Cracks and crevices

73 *Opisina arenosella* belongs to .......... family.
   a. Curculionidae
   b. Cryptophasidae
   c. Scarabaeidae
   d. Arctiidae

74 Female of rhinoceros beetle lays eggs in .......... a. Soil
   b. Manure pit
   c. Coconut
   d. On palm

75 Following is the scientific name of the coccid pest of tea
   a. *Saissetia coffearia*
   b. *Homona coffearia*
   c. *Empoasca flavescens*
   d. *Toxoptera aurantii*

76 .......... is a monophagous pest on mango having quarantine importance
   a. Fruit fly
   b. Mango stone weevil
   c. Stem borer
   d. Mealybug

77 Site of pupation of Guava bark eating caterpillar
   a. Bud hole
   b. Hole in the stem
   c. Soil
   d. Midrib of leaf

78 Woolly apple aphid damages.....
   a. Only above ground plant parts
   b. Only root system
   c. Both above plant parts and root system
   d. Only foliage

79 Number of gregariously feeding larva remain inside web in Mango...
   a. Stem borer
   b. Leaf webber
   c. Thrips
   d. Shoot borer

80 Scientific name of ber fruit fly is .......... a. *Bactrocera dorsalis*
   b. *Bactrocera zonata*
   c. *Virolula isocrates*
   d. *Carpomyia vasuviana*
PART - B (SUBJECTIVE)

Q.1.A Enlist the major insect-pest of Citrus with their scientific name and describe nature of damage and control measure of Fruit sucking moth

Q.1.B Describe the life cycle of following insect- pest (Any Four)
   1. Mango hopper
   2. Rhinoceros beetle
   3. Guava bark eating caterpillar
   4. Apple woolly aphid
   5. Grape stem girdler
   6. Tea mosquito bug

Q.2.A Narrate the nature of damage of following insect-pest (Any five)
   1. Mango stem borer
   2. Anar butterfly
   3. Coconut eriophyid mite
   4. Cut worm of medicinal plant
   5. Banana rhizome weevil
   6. Shoot borer of lemon grass

Q.2 B Give the reason(s) of following
   1. Any injury on coconut trunk should be plaster with clay or cement
   2. It is advisable to avoid manure pits in the vicinity of coconut gardens
   3. It is advisable to minimum use of chemical insecticides in medicinal crop
   4. Smoking in citrus orchard during evening hours is suggested to citrus growers.
   5. The webbed terminal shoots of sapota should be collected and destroyed

Q.3 Give the IPM strategies for the following insect- pest (Any five)
   1. Mango fruitfly
   2. Banana Psudostemborer
   3. Rhinoceros beetle
   4. Apple stem borer
   5. Aonla gall forming caterpillar
   6. Custard apple mealy bug

Q.4A Enlist the major Insect-pest of Coconut with their scientific name and describe nature of damage and control measure of Red palm weevil

Q.4B Answer the following in short (Any four)
   1. Give the mechanical control of anar butterfly and mango stem borer
   2. Enlist the main IPM components
   3. Enlist the major insect pest of grapes
   4. Enlist the five newer insecticides
   5. Give the name vector(s) of papaya leaf curl and Citrus greening
   6. Enlist the various mite species infesting tea.
   7. Enlist the pest that attacks foliage of Aonla.