

Department of Biochemical Engineering and Biotechnology

Minutes of the Departmental Faculty Board Meeting (DFB-08/2019-2020)

February 09, 2020

The eighth meeting of the *Departmental Faculty Board* for the academic session 2019-2020 was held on **Thursday, February 06, 2020 at 11:00 AM** in the Departmental Committee Room (I-230).

The following members were present:

Prof. D. Sundar	Chairman
Prof. Saroj Mishra	Member
Prof. Ashok Srivastava	Member
Prof. Sunil Nath	Member
Prof. Prashant Mishra	Member
Prof. Atul Narang	Member
Prof. Shilpi Sharma	Member
Prof. Preeti Srivastava	Member
Prof. Ravikrishnan Elangovan	Member
Prof. Ziauddin Shaikh Ahammad	Member
Prof. Lucinda E. Doyle	Member
Prof. Rohan Jain	Member
Prof. Ishaan Gupta	Member
Prof. Ritu Kulshreshtha	Convener

1. Confirmation of the minutes of 7th meeting of the DFB for the session 2019-2020 held on January 01, 2020.

The members noted the minutes of 7th meeting of DFB held on January 01, 2020, as recorded and circulated amongst the members. The minutes were confirmed noting the following observation/modification under Item 5 of the minutes:

Item 5: Minutes be recorded as follows with changes indicated in bold/italics:

The board approved the allocation of lab space for Prof. Lucinda E. Doyle and Prof. Ishaan Gupta as given below:

Sl.	Faculty	Allocation	Current Lab incharge	New Lab incharge
1	Prof. Lucinda Doyle	Block I, Room No. 127	GPA	LED
2	Prof. Ishaan Gupta	Block I, Room No. 25	AKS	IG

2. Matters arising out of the minutes.

- The board discussed the current status of the allocation of lab space (Item 5 of DFB 07/2019-2020).
- The board noted that the lab space (I-127) occupied by Prof. G.P. Agarwal has not yet been vacated. The board had recommended a year back that the regular faculty will have priority on office/lab space over the needs of Emeritus Faculty, and space allocated to Emeritus Faculty will be subject to availability. The board noted that the lab space (I-127) should have

been vacated by Prof. Agarwal for allocation to the new faculty joinee and the board wondered why Prof. Agarwal had not relocated to the newly assigned lab space (old Storekeeper office).

- The board also recommended that Prof. A.K. Srivastava handover the lab space (I-25) to the new faculty joinee Prof. Ishaan Gupta.
- The board recommended that the proposed lab reassignment be honored by the concerned faculty members and vacate the lab spaces (I-127 and I-25) for occupation by the new faculty joinees.
- It was agreed to refer the matter to the Director for resolution, if required.

3. Status of utilization of budget allocated by the Institute.

The Head presented the status of current utilization of the Institute budget heads and asked all concerned buyers to complete the purchase process from PLN03 and PLN03F. It was decided that all the faculty should complete their spending from NPN05 by February 14, 2020. Subsequently, the reallocation of the remaining budget would be initiated. It was informed that the utilization of grant under different *Institute budget heads* can be monitored using the link provided in the RTI site (*under Financial year 2019-2020*) of the departmental webpage.

Further, the Head requested the faculty to submit the budgetary requirements (with justification and quotations) from Institute funds for the next FY 2020-2021 to the HoD's office by March 01, 2020.

4. Recruitment of Technical Staff (Senior Lab Assistant - SLA) - QP preparation

Prof. Preeti Srivastava and Prof. Atul Narang informed the board about the plans for conducting the written/lab exams for recruitment of SLA. The board requested them to coordinate the setting of question paper and submit a concrete plan for the conduct of written exam and practicals in the next DFB meeting. They were also requested to complete the exercise of setting QP by March 1st week.

5. Biological waste management and disposal

Prof. Preeti Srivastava presented the draft Laboratory Biosafety Manual (**Annexure 1**) prepared by her in line with the DBT guidelines. The members were requested to provide their feedback on the draft manual.

6. Office and Lab Furniture for new building 99C1

The Head requested the faculty to provide their inputs on special laboratory furniture to Prof. Ziauddin Shaikh Ahammad for the new labs in block 99C1 by February 14, 2020.

7. Closure of audit observations and issues of inventory items

The Head requested the faculty members to address the audit observations related to their purchases from previous FYs and suggested that these be completed by February 11, 2020, so that these can be immediately sent for closure during the ongoing audit process for FY 2018-2019.

8. Any other item with the permission of the Chair

a) Revision of Faculty Strength at DBEB, IITD

It was informed by the Head that the Institute is in the process of revising the faculty strength of different academic units, for which inputs have been sought (**Annexure 2**). The board suggested the previously formed sub-committee to formulate a new M.Tech program could deliberate on this matter and submit their recommendations by February 24, 2020, so that this can be finalized in the next DFB scheduled on February 26, 2020. The Committee comprising of Prof. T.R. Sreekrishnan (Chairperson), Prof. D. Sundar (HoD), Prof. P. Srivastava (Convener) and Prof. A. Narang was also requested to co-opt other faculty including Prof. ZA Shaikh, Prof. S. Mishra, Prof. I. Gupta and Prof. S. Sharma.

b) Scheme for early selection of meritorious NIT students to PhD programme

The Board discussed the scheme for early selection of meritorious NIT students to PhD program at IIT Delhi and generally welcomed this scheme (**Annexure 3**). It was decided that the Department could possibly have an in-take of upto 15 summer interns under this scheme.

The meeting ended with a vote of thanks to the Chair.

Ritu Kulshreshtha
Convener, DFB

Distribution

All Faculty (by email)

Laboratory Biosafety Manual



**Department of Biochemical Engineering and
Biotechnology,
Indian Institute of Technology Delhi**

Bio-safety levels

The guidelines for Microbiological and Biomedical Laboratories suggest four Biosafety levels in incremental order depending on the nature of work.

Biosafety Level 1: These practices, safety equipment and facilities are appropriate for defined and characterised microorganisms not known to cause disease in healthy adult human. Laboratory personnel are required to have training and to be supervised by a scientist with general training in microbiology.

Biosafety Level 2: These practices, safety equipment and facilities are applicable in clinical, diagnostic, teaching and other facilities in which work is done with the broad spectrum of indigenous moderate-risk agents present in the community and associated with human disease of varying severity. Laboratory workers are required to have specific training in handling pathogenic agents and to be supervised by competent scientists. Access to the laboratory is controlled.

Biosafety level 3: These practices, safety equipment and facilities are applicable to clinical, diagnostic, teaching research or production facilities in which work is done with indigenous or exotic agents where the potential for infection by aerosols is real and the disease may have serious or lethal consequences. Personnel are required to have specific training in work with these agents and to be supervised by scientists experienced in this kind of microbiology. The access is strictly controlled.

Biosafety level 4: These practices, safety equipment and facilities are applicable to work with dangerous and exotic agents which pose a high individual risk of life-threatening disease. Strict training and supervision are required and the work is done in specially designed laboratories under stringent safety conditions, including the use of safety cabinets and positive pressure personnel suits. Access is strictly limited.

Guidelines for research activities

Category I: Which are exempt for the purpose of intimation and approval of competent authority.

- i. Isolation, cultivation and storage of Risk Group (RG) 1 microorganisms those are abundant in natural environment (Listed in Annexure I).
- ii. Experiments on RG 1 microorganisms provided that the experiments will not increase environmental fitness and virulence of the microorganisms.

iii. **Category I genetic engineering experiments on microorganism:**

This category includes experiments which generally do not pose significant risk(s) to laboratory workers, community or the environment and the modifications have no effect on safety concerns. Examples are:

- a. Insertions of gene into RG 1 microorganism from any source, deletions, or rearrangements that have no adverse health, phenotypic or genotypic consequence. Modification should be well characterized and that the gene functions and effects are adequately understood to predict safety.
- b. Experiments involving approved host-vector systems provided that the donor DNA is originated from RG 1 microorganism, not derived from pathogens. The DNA to be introduced should be characterized fully and will not increase host or vector virulence.
- c. Experiments involving the fusion of mammalian cells which generate a non-viable organism, example, the construction of hybridomas to generate monoclonal antibodies.
- d. Any experiments involving microorganism belonging to RG 1. For e.g. self-cloning, fusion of protoplasts between non-pathogenic RG 1 organism.

Before commencement of Category I GE experiments, the investigator should intimate the IBSC about the objective and experimental design of the study along with organisms involved. IBSC should review the same as and when convened for record or action if any. It is desirable to designate a separate area in the facility with proper labelling for Category I

Category II: Those requiring prior intimation of competent authority.

BSL-2 will be applicable for:

- i. Isolation, cultivation and storage of RG 2 microorganisms.
- ii. Handling of environmental samples collected from environment that is unlikely to contain pathogens. Isolation of microorganisms from those samples and subsequent experiments.
- iii. Experiments on RG 2 microorganisms or isolates from environment mentioned above, provided that the experiments will not increase environmental fitness and virulence of the microorganisms.
- iv. **Category II genetic engineering experiments on microorganism:**
These experiments may pose low-level risk(s) to laboratory workers, community or the environment. Examples are:

- a. Experiments involving the use of infectious or defective RG 2 viruses in the presence of helper virus.
- b. Work with non-approved host/vector systems where the host or vector either:
 - does not cause disease in plants, humans or animals; and/ or
 - is able to cause disease in plants, humans or animals but the introduced DNA is completely characterized and will not cause an increase in the virulence of the host or vector.
 - experiments using replication defective viruses as host or vector.
- c. Experiments with approved host/vector systems, in which the gene inserted is:
 - a pathogenic determinant;
 - not fully characterized from microorganisms which are able to cause disease in humans, animals or plants; or an oncogene.
- d. Modification leading to persistent transient disruption of expression of gene(s) that are involved directly or indirectly in inducing pathogenicity, toxicity, survival, or fitness. Modification should be well characterized and the gene functions and effects are adequately understood to predict safety.
- e. Experiments in which DNA from RG 2 or 3 organisms are transferred into non-pathogenic prokaryotes or lower eukaryotes. However, handling of live cultures of RG 3 organism should be performed in BSL-3 laboratory.

Category III: Those requiring review and approval of competent authority before commencement.

BSL-3 will be applicable for:

- i. Isolation, cultivation and storage of RG 3 microorganisms.
- ii. Handling of environmental samples collected from environment that is likely to contain pathogens of potential disease consequences. Isolation of microorganisms from those samples and subsequent experiments.
- iii. Experiments on RG 3 microorganisms or isolates from environment mentioned above provided that the experiments will not increase environmental fitness and virulence of the microorganisms.
- iv. **Category III and above genetic engineering experiments on microorganism:**

These kinds of experiments pose moderate to high risk(s) to laboratory workers, community or the environment. Examples are:

 - a. Experiments on RG 2 and RG 3 microorganisms where insertion of gene directly involved in production of toxin or allergen or antimicrobial compounds.
 - b. Insertions of gene into RG 3 microorganisms from any source, deletions, or rearrangements that affect the expression of genes, whose functions or effects are not sufficiently understood to determine with reasonable certainty if the engineered organism poses greater risk(s) than the parental organism.
 - c. Insertions of nucleic acid from any source, deletions, or rearrangements that have known or predictable phenotypic or genotypic consequence in the accessible environment that are likely to result in additional adverse effects on human and/or animal health or on managed or natural ecosystems, e.g., those which result in the production of certain toxins.

- d. Research involving the introduction of nucleic acids (recombinant or synthetic) into RG 3 organisms.
- e. Genetic engineering of organisms isolated from environment where there are reported cases of disease prevalence and possibility of presence of infectious microorganisms.

For Category IV refer to DBT Biosafety Guidelines

Large scale experiments

In the guidelines, experiments beyond 20 litres capacity for research as well as industrial purposes are included in the category of large scale experimentation/operations. For such activities it is recommended that one should seek approval of the competent authority.

For good large scale practice (GLSP) as well as levels of containment, the following principles of occupational safety and hygiene will be applied.

- i) to keep work place and environment exposure to any physical, chemical or biological agent to the lowest practicable level;
- ii) to exercise engineering control measures at source and to supplement these with appropriate personal protective clothing and equipment when necessary;
- iii) to test adequately and maintain control measures and equipment ;
- iv) to test when necessary for the presence of viable process organisms outside the primary physical containment ;
- v) to provide training of personnel
- vi) to formulate and implement local code of practice for the safety of personnel.

The following safety criteria are to be compiled with for good large scale practice:

- i) The host organism should not be a pathogen, , and should have an extended history of safe use, or have built-in environmental limitations that permit optimum growth in the bioreactor but limited survival with no adverse consequences in the environment.
- ii) The vector/insert should be well characterised and free from known harmful sequences; the DNA should be limited in size as much as possible to perform the intended function; should not increase the stability of the recombinant in the environment unless that is a requirement of the intended function; should be poorly mobilisable; and should not transfer any resistance markers to microorganisms not known to acquire them naturally if such acquisition could compromise the use of a drug to control disease agents in human or veterinary medicine or agriculture.
- iii) The genetically manipulated organism should not be a pathogen and should be assessed as being as safe in the bio-reactor as the host organism, and without adverse consequences in the environment

Release to the environment:

Depending on the types of organisms handled and assessment of potential risks involved appropriate containment facilities must be provided to ensure safety of worker and to prevent unwanted release in the environment.

Biowastes resulting from laboratory experiments, in industrial operations should be properly treated so that the pathogenicity of genetically engineered organisms are either destroyed or rendered harmless before disposal in the environment. Exemption/relaxation of safety measures on specific cases may be considered based on the risk assessment criteria.

For details refer to DBT Biosafety Guidelines

Code of practice

The most important rules are listed below :

1. Mouth pipetting should be prohibited.
2. Eating, drinking, smoking, storing food, and applying cosmetics should not be permitted in the laboratory work area.
3. The laboratory should be kept neat, clean and free of materials not pertinent to the work.
4. Work surfaces should be decontaminated at least once a day and after any spill of potentially dangerous material.
5. Members of the staff should wash their hands after handling infectious materials and animals and when leaving the laboratory.
6. All technical procedures should be performed in a way that minimizes the creation of aerosols.
7. All contaminated liquid or solid materials should be decontaminated before disposal or reuse; contaminated materials that are to be autoclaved or incinerated at a site away from the laboratory should be placed in durable leakproof containers, which are closed before being removed from the laboratory.
8. Laboratory coats, gowns, or uniforms should be worn in the laboratory; laboratory clothing should not be worn in non laboratory areas; contaminated clothing should be disinfected by appropriate means.
9. Safety glasses, face shields, or other protective devices should be worn when necessary to protect the eyes and face from splashes and impacting objects.
10. Only persons who have been advised of the potential hazards and meet any specific entry requirements (e.g. immunization) should be allowed to enter the laboratory working areas; laboratory doors would be kept closed when work is in progress; access to animal houses should be restricted to authorized persons; children are not permitted in laboratory working areas.
11. There should be an insect and rodent control programme.
12. The use of hypodermic needles and syringes should be restricted to parenteral injection and aspiration of fluids from laboratory animals and diaphragm vaccine bottles. Hypodermic needles and syringes should not be used as a substitute for automatic pipetting devices in the manipulation of infectious fluids. Cannulas should be used instead of sharp needles wherever possible.
13. Gloves should be worn for all procedures that may involve accidental direct contact with blood, infectious materials, or infected animals. Gloves should be removed aseptically and autoclaved with other laboratory wastes before disposal. When disposable gloves are not available, re-usable gloves should be used. Upon removal they should be cleaned and disinfected before re-use.
14. All spills, accidents and overt or potential exposures to infectious materials should be reported immediately to the laboratory supervisor. A written record should be prepared and maintained. Appropriate medical evaluation, surveillance, and treatment should be provided.

15. The laboratory supervisor should ensure that training in laboratory safety is provided. A safety or operations manual that identifies known and potential hazards and that specifies practices and procedures to minimise or eliminate such risks should be adopted. Personnel should be advised of special hazards and required to read and follow standard practices and procedures.

Guidelines for the surveillance of workers handling microorganisms of Risk Group I:

These microorganisms are unlikely to cause human disease or animal disease of veterinary importance. Ideally, however, staff members should be subjected to a pre-employment health surveillance procedure regarding past medical history. Prompt reporting of illness or laboratory accident is desirable and all staff members should be made aware of the importance of maintaining good laboratory safety practice.

Guidelines for the surveillance of workers handling microorganisms of Risk Group II:

1. Pre-employment of preplacement health surveillance is necessary. This screening should include the past medical history. A clinical examination and the collection of a baseline serum sample would be advantageous and, in some cases, may be necessary.
2. The laboratory should maintain an up-to-date list of the employees' family medical practitioners.
3. Records of illness and absence should be kept by the laboratory director and it is the responsibility of the laboratory worker and his own medical adviser to keep the director informed of all absences due to illness.
4. Women of child-bearing age should be made aware, in unequivocal terms, of the risks to the unborn child of occupational exposures to microbiological agents, such as rubella and cytomegalovirus. The precise steps taken to protect the foetus will vary, depending on the microorganisms to which exposure may occur.

Decontamination and Disposal

Autoclaving is the procedure of choice for all decontamination processes. The autoclave should be of the gravity displacement type and worked upon at 1.4 kg/cm² pressure for 30 minutes.

Alternate methods, if an autoclave is not available include:

- boiling for 30 minutes, preferably in water containing sodium bicarbonate,
- use of a pressure cooker at the highest attainable working pressure.

Disinfectants and chemicals:

Sodium hypochlorite and formaldehyde are the disinfectants recommended for general laboratory use.

For special purposes phenolic compounds, various surface-active and/or lipid-destroying agents, including alcohols, iodine and iodophors and other oxidising agents, as well as very high or extremely low pH, can be effective provided that it has been established that the agent to be destroyed is not resistant to the procedure.

Other methods:

The use of dry heat is discouraged because of its unpredictable variations. Similarly, ultraviolet irradiation is unsuitable.

Disposal:

An identification and separation system for contaminated materials (and their containers) should be established. Categories may be :

- (a) non-contaminated waste that can be disposed of with general waste,
- (b) "sharps"-needles, syringes, etc.,
- (c) contaminated material for autoclaving and recycling,
- (d) contaminated material for disposal.

"Sharps":

Hypodermic needles should be placed in containers with walls that are not readily penetrable. When full, these should be placed in contaminated waste containers and incinerated, even if laboratory practice requires that they are autoclaved first.

Disposable syringes, placed in container, should be incinerated, even if they are autoclaved first.

Contaminated material for autoclaving and recycling:

The material is placed in shallow leakproof containers containing enough of a suitable disinfectant to cover the contents. The containers are then placed in the autoclave. No precleaning is performed; any necessary cleaning or repair is done after autoclaving.

Contaminated material for disposal:

All cultures and contaminated material are normally autoclaved in leakproof containers prior to disposal. Following autoclaving the material may be placed in transfer containers for transport to the incinerator or other point of disposal.

In some situations, the autoclaving step is not required. In such instances the contaminated waste is placed in specially marked containers and transported directly to an incinerator. The best practice is to place a plastic bag for containing the waste in a paperboard box; then contents and container can all be incinerated. If transfer containers are used they should be cleaned and disinfected after emptying the contaminated waste and prior to return to the laboratory. Such containers should be leakproof with tight-fitting covers.

Incineration:

Incineration is the method of choice for final disposal of contaminated waste, including carcasses of laboratory animals. Incineration for this purpose must meet with the approval of public health and air pollution authorities and the safety officer.

Where incinerators are not approved for such use, final disposal methods must be established in cooperation with public health authorities.

For Containment Laboratory III and IV refer to DBT Biosafety Guidelines

Table : Instruction on disposal of laboratory wastes

Laboratory waste type	Disposal Container (s)	Disposal requirements Solid wastes
Solid waste All used gloves, paper towels, gauze, wipes, absorbents, disposable Petri dishes, culture vials, plastic wares, plants or any parts/ tissues, seeds, soil/soil substitute (perlite, vermiculite, peat mass, etc.)	i. The primary container should be leak and puncture proof and must have lid. ii. A label of “biological waste” should be visible on container. iii. It should be lined with a biohazard bag of mandated colour that is leak proof and able to withstand autoclave conditions.	i. Keep container and lid clean at all times. ii. Maintain access to the container - do not put materials on lid. iii. Lid must be in place when waste is not being added to container. iv. No liquid should be discarded along with solid waste. v. The biohazard bag should be 3/4th fill maximum. vi. Do not overfill. vii. To transport container(s) outside the facility for decontamination, ensure that the biohazard bag is sealed and the lid is tightly closed. A trolley for transport is preferred. viii. All solid hazardous waste

		<p>must be autoclaved.</p> <p>ix. Prior to autoclaving, crisscross the bag's biohazard symbol and/or markings with heat sensitive autoclave tape.</p> <p>x. Ensure the autoclave is set for the appropriate time.</p> <p>xi. Once the waste is autoclaved, mark the autoclaved bag with an "Autoclaved/Decontaminated" sticker.</p> <p>xii. Place the autoclaved bag into an opaque bag of mandated colour and seal it.</p> <p>xiii. Store the bag in a place that could be collected for disposal by cleaning personnel.</p> <p>xiv. As an alternative to autoclaving, other waste disposal methods may be employed as prescribed by the local competent authorities (Pollution Control Board).</p>
<p>Liquid Waste Any media, liquids coming from Petri dishes, culture vials, lab equipment, recombinant Nucleic Acids (rNA) in all forms (natural and synthetic e.g., DNA, RNA, shRNA, etc.).</p>	<p>i. The container should be leak and puncture proof and must have lid.</p> <p>ii. A label of "biological waste" should be visible on container.</p>	<p>i. Liquid waste must be separated from solid waste.</p> <p>ii. Liquid waste must be decontaminated on site with an appropriate disinfectant/bleach with appropriate period of exposure.</p> <p>iii. Flush the disinfected material down the sink, allowing the cold water to run for a period of time (at least 5 minutes).</p> <p>iv. Do not flush non-aqueous solutions, such as liquefied agarose or unfiltered broths, down the drain as they will clog the drain pipes.</p> <p>Note: Liquid waste generated from higher containment laboratory (BSL-2 and above) should be autoclaved.</p>

<p>Sharps All needles, syringes, scalpels, razor blades, pipette tips, Pasteur pipettes, glass ware, capillary tubes, slides and cover slips, contaminated broken glassware.</p>	<p>i. The container must be rigid, leak proof, puncture proof and have lid. ii. Keep baffle in place. iii. Line with a biohazard bag of mandated colour. iv. Label with "BIOHAZARD SHARPS" sticker.</p>	<p>i. All sharps must be placed in appropriate sharps container. ii. Once the container is $\frac{3}{4}$ full, close the top of the container. iii. Sharps contaminated with biological materials must be autoclaved before disposal.</p>
<p>Pathological E.g. Animal carcasses suspected to be or potentially infected; tissues, organs and any body parts; bedding from animal cages, etc.</p>	<p>Must be leak-proof and puncture-proof. Lid must be in place when waste is not being added to container. Line with a red or orange biohazard bag. Label with "BIOHAZARD" and "PATHOLOGICAL WASTE" stickers.</p>	<p>Same as 'solid waste'. Incineration of carcasses.</p>

Color coded bags used for disposal

<p>YELLOW BAGS</p> <p>Infectious waste, bandages, gauze, cotton or any other objects in contact with body fluids, human body parts, placenta etc.</p>	<p>RED BAGS</p> <p>Plastic waste such as catheters, injection syringes, tubings, iv bottles</p>	<p>BLUE BAGS</p> <p>All types of glass bottles and broken glass articles, outdated & discarded medicines</p>	<p>BLACK CARBOY</p> <p>Needles without syringes, blades, sharps and all metal articles.</p>
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Annexure I

Agency for collection of Biowaste

Biotic waste solutions Pvt Ltd

Contact person

Ankit Gupta

General Manager-Marketing, Biotic Waste Solutions Pvt Ltd

Contact no. +91 9899910083

Email. ankit@biotic.co.in

Name of Contact person (for collection of waste): Dinesh

Mobile number : 9650804983

Name of contact person (DBEB) : Sumeet Kapoor

Mobile number : 9268753638

Name of contact person (DBEB) : Anish Raju

Mobile number : 9871737442

Pick up days : Monday, Wednesday, Friday (on call emergency)

**Please do not leave biowaste in open corridors or parking area.
Keep it in your labs and bring it only when collection vehicle
comes to the Department.**

Annexure II

Facility Design

Operational Guide for BSL-1 Facility

A) Facility design

- i. Facility should be a fully enclosed space bounded by walls, doors, windows, floors and ceilings.
- ii. Ample space must be provided for the safe conduct of laboratory procedures.
- iii. Walls, ceiling, and floors should be smooth, easily cleanable, impermeable to liquids, and resistant to the chemicals and disinfectants normally used in the laboratory. Floors should be slip resistant. Exposed pipes and ducting should stand clear of walls. Horizontal runs should be avoided to prevent dust collection.
- iv. Adequate illumination should be ensured for carrying out all activities. Undesirable reflection is to be avoided.
- v. Bench tops should be impervious to water and resistant to disinfectants, acids, alkalis, organic solvents and moderate heat.
- vi. Laboratory furniture should be sturdy and open spaces between and under benches, cabinets and equipment should be accessible for cleaning.
- vii. Storage space must be adequate to hold supplies for immediate use and thus prevent clutter on bench tops and in the aisles. Additional long-term storage space, conveniently located outside and working areas, should also be provided.
- viii. Wash-basins, with running water, should be provided in each laboratory room, preferably near the exit.
- ix. Doors should have appropriate fire ratings, be self-closing, and have vision panels.
- x. There are no specific ventilation requirements. In planning new facilities, consideration should be given for providing a mechanical ventilation system that provides an inward air flow and exhaust without recirculation. If there is no mechanical ventilation, windows should be openable, preferably having fly proof screens. Skylights should be avoided.
- xi. Drainage exits should be fitted with barriers to prevent entry of arthropods and rodents.
- xii. Space and facilities should be provided for the safe handling and storage of solvents, radioactive materials and compressed gases.
- xiii. Safety systems should cover fire, electrical emergencies, emergency shower and eyewash facilities.
- xiv. First-aid areas or rooms suitably equipped and readily accessible should be available.
- xv. A good-quality and dependable water supply is essential. There should be no cross-connections between sources for laboratory purposes and the drinking water supply. The public water system must be protected by a back-flow preventer.
- xvi. A reliable electricity supply with adequate capacity should be available. There should be emergency lighting to permit safe exit. A standby generator with automatic cut-off is desirable for the support of essential equipment-incubators, freezers, etc.
- xvii. There should be an insect and rodent control measures.
- xviii. Facilities for storing outer garments and personal items and for eating and drinking should be provided outside the working areas.
- xix. "No Smoking" "No Eating" and "No Drinking" signs should be displayed clearly inside and outside the laboratory.
- xx. Access to the laboratory area should be designed to prevent entrance of free-living arthropods and other vermin.

B) Safety Equipments

- i. Pipetting aids-to replace mouth pipetting.

- ii. Screw-cap tubes and bottles - to provide positive specimen containment.
- iii. Disposable Pasteur pipettes, whenever available, to avoid glass.
- iv. Sterile plastic disposable transfer loops and spreader etc. to avoid incineration of regular loops, glass spreader etc.

C) Personal Protective Equipment

Working in BSL-1 laboratory does not require any Personal Protective Equipment (PPE), although care should be made to avoid spillage of biological material on street clothing for which use of apron is recommended.

D) Procedures

- i. Mouth pipetting should be prohibited.
- ii. Eating, drinking, storing food, and applying cosmetics should not be permitted in the laboratory work area.
- iii. Avoid touching various body parts while handling the microorganisms.
- iv. Wash hand after entering, post work and before leaving the laboratory with sanitizing agents.
- v. The laboratory should be kept neat, clean and free of materials not pertinent to the work.
- vi. Work surfaces should be decontaminated at least once a day and after any spill of potentially dangerous material.
- vii. Members of the staff should wash their hands after working before leaving the laboratory.
- viii. All technical procedures should be performed in a way that minimizes the creation of aerosols.
- ix. Laboratory doors would be kept closed when work is in progress.
- x. Children are not permitted in laboratory working areas.

E) Laboratory monitoring

- i. There should be no unauthorized entry in the laboratory.
- ii. Only the trained personnel to enter the laboratory.
- iii. Entry and exit should be limited when work is in progress.
- iv. Immediately after work, the workplace and the used instruments should be cleaned with a disinfectant and the materials used in work should be placed back to its position.
- v. No viable cultures are left unattended and either stored or incubated as per need.
- vi. Record of work should be duly registered in the register available.

F) Waste management

There is no specific requirement on waste management in BSL-1 facility. However, waste disposal procedure must meet the pollution control requirements. Any effluents from laboratories should be pre-treated and microbiological testing of treated effluents along with record should be available.

G) Health and Medical Surveillance

These microorganisms are unlikely to cause human or animal diseases of veterinary importance. Ideally, however, staff members should be subjected to a pre-employment health surveillance procedure regarding medical history. Prompt reporting of illness or laboratory accident is desirable and all staff members should be made aware of the importance of maintaining good laboratory safety practice.

H) Emergency procedures

All spills, accidents and overt or potential exposures to infectious materials should be reported immediately to the laboratory supervisor. A written record should be prepared and maintained. Appropriate medical evaluation, surveillance and treatment should be provided.

The operational program for BSL-1 laboratory will also apply to Biosafety Level 2 laboratory, with additional modifications as follows:

A) Facility design

- i. An autoclave for decontamination of potentially hazardous laboratory wastes should be available in the same building as the laboratory.
- ii. Biological safety cabinets for handling of risk-inherent microorganisms of RG 2 should be used.
- iii. Laboratory may be kept under constant CCTV surveillance.
- iv. The biohazard warning symbol and sign must be displayed on the door(s) of the rooms where microorganisms of RG 2 are handled.

B) Safety instruments

- i. Autoclaves - to sterilize contaminated material.
- ii. Biological safety cabinets to be used whenever:
 - a. Procedures with a high potential for creating hazardous aerosols. These may include centrifugation, grinding, blending, vigorous shaking or mixing, sonic disruption, opening containers harbouring hazardous materials whose internal pressure may be different from the ambient pressure, intranasal inoculation of animals, and harvesting infected tissues from animals or eggs.
 - b. High concentrations or large volumes of hazardous microorganisms are handled. Such materials may be centrifuged in the open laboratory if sealed heads or centrifuge safety cups are used and if they are opened only in a biological safety cabinet.

C) Personal Protective Equipment

- i. The use of laboratory coats, gowns or uniforms is required to prevent contamination of street clothing.
- ii. Goggles and face protection must be used when there is a potential for splashes of microorganisms or other hazardous materials.
- iii. Face mask and appropriate gloves may be worn as protection while handling animals.
- iv. Appropriate gloves should be worn for all procedures that may involve accidental direct contact with blood, infectious materials, or infected animals. Gloves should be removed aseptically and autoclaved with other laboratory wastes before disposal. When disposable gloves are not available, re-usable gloves should be used. Upon removal they should be cleaned and disinfected before re-use.
- v. All PPE should be removed so that the transfer of infectious materials to areas beyond where they or animals are being handled is minimized.
- vi. Used disposable PPE should be disposed off with other contaminated waste and reusable PPE (i.e., goggles) should be appropriately decontaminated before reuse.
- vii. Reusable protective clothing should be laundered through laboratory laundry facility only it must not be taken home. If visibly contaminated, laundry should be placed in a biohazard bag before being placed with other items to go to laundry.

D) Procedures

- i. All contaminated liquid or solid materials should be decontaminated before disposal or reuse; contaminated materials that are to be autoclaved or incinerated at a site away from the laboratory should be placed in durable leak-proof containers, which are closed before being removed from the laboratory.
- ii. Containers used to collect, handle, process, store, or transport within a facility, potentially infectious materials must be durable, leak-proof and have a lid. The containers must be properly labelled with the contents and a biohazard symbol.
- iii. Laboratory coats, gowns, or uniforms should be worn in the laboratory; laboratory clothing should not be worn in non-laboratory areas; contaminated clothing should be disinfected by appropriate means.
- iv. Safety glasses, face shields and other protective devices should be worn to protect eyes and face from splashes and impacting objects.

- v. Only persons who have been advised of the potential hazards and meet any specific entry requirements (e.g. immunization) should be allowed to enter the laboratory working areas.
- vi. Hypodermic needles and syringes should not be used as a substitute for automatic pipetting devices in the manipulation of infectious fluids. Cannulas should be used instead of sharp needles wherever possible.
- vii. Never wear contact lenses when working with infectious microorganisms.
- viii. Add disinfectant to water baths to contain spread of infectious substances.
- ix. Use sealed rotors, sealed buckets, or a guard bowl cover complete with gasket as well as safety centrifuge tubes (tube or bottle carrier with sealable cap or “O” ring cap) for potentially infectious samples/otherwise hazardous samples. Before use, tubes should be checked for cracks.
- x. All technical procedures should be performed to minimize the formation of aerosols and droplets. Whenever there is an increased risk(s) of aerosolization, work should be conducted in a biological safety cabinet.
- xi. Always use secondary leak-proof containers when transporting samples, cultures, inoculated Petri dishes, and other containers of hazardous microorganisms. Packages containing viable microorganisms must be opened in a facility having an equivalent or higher level of physical containment unless the microorganism is biologically inactivated or incapable of reproduction.

E) Laboratory monitoring

Monitoring should ensure that:

- i. Only highly trained personnel are entering in the facility.
- ii. Person working in the facility are not transporting the laboratory materials including hazardous organism outside the laboratory environment either without permission or without proper transport strategy with prior approval from competent authority.
- iii. Person working in the laboratory are well aware about the microorganism(s) to be handled and its associated risks.
- iv. Accidental spill or splashes are cleaned immediately, reported and recorded.

F) Waste management

Decontamination and disposal mechanism should be in strict adherence to those mentioned in “Decontamination and disposal”.

- i. Autoclaves and sterilizers for treatment of solid wastes need specially designed accommodation and services.
- ii. Incinerators may need to be of special design and equipped with after burners and smokeconsuming devices.

G) Health and Medical Surveillance

- i. Pre-employment health surveillance is necessary. This screening should include the past medical history. A clinical examination and the collection of a baseline serum sample would be advantageous and, in some cases, may be necessary.
- ii. Records of illness and absence should be kept by the facility in-charge and it is the responsibility of the laboratory worker and his own medical officer to keep the facility in-charge informed of all absences due to illness.
- iii. Women of child-bearing age should be made aware, in unequivocal terms, of the risk(s) to the unborn child of occupational exposures to hazardous microorganisms, such as Rubella, Cytomegalovirus, etc. The precise steps taken to protect the foetus will vary, depending on the microorganisms to which exposure may occur.

H) Emergency Procedures

Same as BSL-1

For Category III and IV refer to DBT Biosafety Guidelines

Annexure III

List of Microorganisms belonging to Risk group I

Bacteria

- *Acetobacter* spp.
- *Actinoplanes* spp.
- *Agrobacterium* spp.
- *Alcaligenes aquamarinus*
- *Aquaspirillum* spp.
- *Arthrobacter* spp.
- *Azotobacter* spp.
- *Bacillus* spp., except *cereus* and *anthracis*
- *Bifidobacterium* spp., except *dentium*
- *Bradyrhizobium* spp.
- *Brevibacterium* spp.
- *Caryophanon* spp.
- *Clostridium* spp. i.e. *C. aceticum*, *C. acetobutylicum*, *C. acidiuric*, *C. cellobiparum*, *C. kluuyveri*, *C. thermoaceticum*, *C. thermocellum*, *C. thermosulfurogenes*
- *Corynebacterium* spp. i.e. *C. glutomicum*, *C. lilium*
- *Enterococcus faecium*
- *Erwinia* spp. except *E. chrysanthemi*, *E. amylovora* and *E. herbicola*
- *Gluconobacter* spp.
- *Klebsiella planticola*
- *Lactobacillus* spp. i.e. *L. acidophilus*, *L. bauaricus*, *L. brevis*, *L. buchneri*, *L. casei*, *L. cellobiosis*, *L. fermentum*, *L. helveticus*, *L. sake*
- *Lactococcus lactis*
- *Leuconostoc* spp.
- *Lysobacter* spp.
- *Methanobacter* spp.
- *Methylomonas* spp.
- *Micrococcus* spp.
- Nonpathogenic *Escherichia coli* e.g. ATCC 9637, NCIB 8743, K12 and derivatives
- *Pediococcus* spp.
- *Pseudomonas* spp. i.e. *P. fluorescens*, *P. gladioli*, *P. syringae*
- *Ralstonia* spp.
- *Rhizobium* spp.
- *Rhodobacter* spp.
- *Rhodopseudomonas* spp.
- *Rickettsiella* spp.
- *Staphylococcus carnosus*
- *Streptococcus salivarius*
- *Streptomyces* spp.
- *Thermobacteroides* spp.
- *Thermus* spp.
- *Thiobacillus* spp.
- *Vibrio* spp. i.e. *V. fischeri*, *V. diazotrophicus*

Fungi

- *Agaricus bisporus*
- *Acremonium* spp. i.e. *A. chrysogenum*, *A. elegans*,
- *Actinomucor elegans*
- *Ashbya gossypii*
- *Aspergillus oryzae*
- *Aureobasidium pullulans*
- *Blakeslea trispora*
- *Brettanomyces bruxellensis*

- *Candida* spp. i.e. *C. boindinii*, *C. utilis*
- *Chaetomium globosum*
- *Cladosporium cladosporioides*
- *Claviceps* spp. i.e. *C. purpurea*, *C. paspali*
- *Coprinus cinereus*
- *Cunninghamella* spp. i.e. *C. blakesleana*, *C. elegans*
- *Cyathus stercoreus*
- *Dacrymyces deliquescens*
- *Debaryomyces hansenii*
- *Engyodontium album*
- *Hansenula* spp. i.e. *H. anomala*, *H. polymorpha*
- *Hypholama* spp. i.e. *H. fasciculare*, *H. roseonigra*
- *Lentinus edodes*
- *Lipomyces lipofer*
- *Metarhizium anisopliae*
- *Monascus pupureus*
- *Moniliella suaveolens*
- *Mortierella vinacea*
- *Mucor* spp. i.e. *M. mucedo*, *M. plumbeus*, *M. rouxii*
- *Neurospora* spp. i.e. *N. crassa*, *N. sitophilla*
- *Nigrospora sphaerica*
- *Oxyporus populinus*
- *Pachysolen tannophilus*
- *Paecilomyces varioti*
- *Penicillium* spp. i.e. *P. funiculosum*, *P. camemberti*, *P. chrysogenum*
- *Phycomyces blakesleanus*
- *Pichia* spp. i.e. *P. membranae faciens*, *P. farinosa*, *P. guilliermondii*, *P. stipitis*
- *Pleurotus ostreatus*
- *Rhizoctonia solani*
- *Rhodosporidium toruloides*
- *Rhodotorula glutinis*
- *Saccharomyces cerevisiae*
- *Schizosaccharomyces pombe*
- *Schwanniomyces occidentalis*
- *Sordaria macrosopra*
- *Thanatephorus cucumeris*
- *Trametes versicolor*
- *Trichoderma* spp. i.e. *T. harzianum*, *T. viride*
- *Trigonopsis variabilis*
- *Verticillium lecanii*
- *Volvariella volvacea*
- *Wallernia sebi*
- *Xeromyces bisporus*
- *Zygorhynchus moelleri*
- *Zygosaccharomyces* spp. i.e. *Z. bailii*, *Z. rouxii*

Virus

- Apathogenic, endogeneous, animal retroviruses
- Attenuated viral strains which are accepted vaccines. Only a limited number of passages in defined cell culture or host-systems are allowed
- Baculoviruses of insects
- Newcastle disease virus - strains licensed for vaccine use
- Influenza virus A/PR/8/34
- Poikilothermal vertebrate retrovirus
- Rinderpest - attenuated virus strain (e.g. Kabatte-O) licensed for vaccine use.
- Viral strains from fungal or bacterial systems, provided they do not contain virulence-factors and are described as apathogenic for higher animals and human beings

List of Risk Group 2 microorganisms

Bacteria

- *Acinetobacter* spp. i.e., *A. calcoaceticus*, *A. lwoffii*
- *Actinobacillus* spp.
- *Actinomadura* spp. i.e., *A. madurae*, *A. pelletieri*
- *Actinomyces* spp. i.e., *A. israelii*, *A. bovis*
- *Aeromonas hydrophila*
- *Afipia* spp
- *Aggregatibacter actinomycetemcomitans*
- *Agrobacterium radiobacter*
- *Alcaligenes* spp.
- *Amycolata autotrophica*
- *Anaplasma* spp.
- *Arachnia propionica*
- *Archanobacterium haemolyticum*
- *Arizona hinshawii* - all serotypes
- *Bacillus* spp. i.e., *B. anthracis*, *B. cereus*
- *Bacteroides* spp.
- *Bartonella* spp. i.e., *B. bacilliformis*, *B. henselae*
- *Bifidobacterium dentium*
- *Bordetella* spp. i.e., *B. avium*, *B. bronchiseptica*, *B. parapertussis*, *B. pertussis*, *B. quintana*, *B. vinsonii*
- *Borrelia* spp. i.e., *B. burgdorferi*, *B. recurrentis*, *B. duttonii*, *B. vici*
- *Brucella ovis*
- *Burkholderia* spp. i.e., *B. cepacia*, *B. mallei* (*Pseudomonas mallei*)
- *Campylobacter* spp. i.e., *C. coli*, *C. fetus* subsp. *fetus*, *C. jejuni*
- *Cardiobacterium hominis*
- *Chlamydia* spp. i.e., *C. pneumonia*, *C. trachomatis*
- *Chlamydophila pneumonia*
- *Chlamydia trachomatis*
- *Citrobacter* spp.
- *Cladosporium* (*Xylohypha*) *trichoides*
- *Clostridium* spp. i.e., *C. chauvoei*, *C. difficile*, *C. fallax*, *C. haemolyticum*, *C. histolyticum*, *C. novyi*, *C. perfringens*, *C. septicum*
- *Corynebacterium* spp. i.e., *C. diphtheriae*, *C. minutissimum*, *C. pseudotuberculosis*, *C. renale*, *C. ulcerans*
- *Coxiella burnetii* - specifically the Phase II, Nine Mile strain, plaque purified, clone 4
- *Cytophaga* spp. pathogenic to animals
- *Dermatophilus congolensis*
- *Edwardsiella tarda*
- *Eikenella coreodens*
- *Enterobacter* spp.
- *Enterococcus faecalis*
- *Eperythrozoon* spp.
- *Erysipelothrix* spp. i.e., *E. rhusiopathiae*, *E. tonsillarum*
- *Escherichia coli* (excluding non-pathogenic strains)
- *Flavobacterium meningosepticum*
- *Fluoribacter bozeman*
- *Francisecla tularensis*
- *Fusobacterium* spp. including *F. necrophorum*
- *Gardnerella vaginalis*
- *Haemophilus* spp. i.e., *H. ducreyi*, *H. influenzae*
- *Helicobacter* spp. i.e., *H. pylori*, *H. hepaticus*
- *Klebsiella* spp. i.e., *K. pneumonia*, *K. mobilis*, *K. oxytoca*
- *Legionella* spp. i.e., *L. pneumophila*
- *Leptospira interrogans* - all serotypes
- *Listeria* spp.

- *Moraxella* spp.
- *Morganella morganii*
- *Mycobacterium BCG vaccine strain*
- *Mycoplasma* spp. i.e., *M. agalactiae*, *M. mycoides*, *M. caviae*, *M. hominis*, *M. pneumoniae*
- *Neisseria* spp. i.e., *N. meningitidis*, *N. gonorrhoeae*
- *Nocardia* spp. i.e., *N. otitidiscaviarum*, *N. brasiliensis*, *N. farcinica*, *N. nova*, *N. otitidiscaviarum*, *N. asteroides*, *N. transvalensis*
- *Pantoea agglomerans*
- *Pasteurella* - all species except those listed in RG 3
- *Peptococcus* spp.
- *Peptostreptococcus* spp.
- *Porphyromonas* spp.
- *Prevotella* spp.
- *Proteus* spp. i.e., *P. mirabilis*, *P. penneri*, *P. vulgaris*
- *Providencia alcalifaciens*
- *Pseudomonas aeruginosa*
- *Rhodococcus equi*
- *Salmonella* spp. i.e., *S. abortusequi*, *S. abortusovis*, *S. arizonae*, *S. choleraesuis*, *S. dublin*, *S. enteritidis*, *S. gallinarum*, *S. meleagridis*, *S. paratyphi*, A, B, C, *S. typhi*, *S. pullorum*, *S. typhimurium*
- *Serpulina* spp.
- *Serratia* spp. i.e., *S. liquefaciens*, *S. marcescens*
- *Shigella* spp. i.e., *S. boydii*, *S. dysenteriae*, *S. flexneri*, *S. sonnei*
- *Sphaerophorus necrophorus*
- *Staphylococcus* spp. i.e., *S. aureus*, *S. epidermidis*
- *Streptobacillus moniliformis*
- *Streptococcus* spp. i.e., *S. agalactiae*, *S. dysgalactiae*, *S. pneumoniae*, *S. pyogenes*, *S. suis*, *S. uberis*, *S. equi*
- *Streptomyces somaliensis*
- *Treponema* spp. i.e., *T. pertenue*, *T. carateum*, *T. pallidum*
- *Ureaplasma urealyticum*
- *Veillonella* spp.
- *Vibrio* spp. i.e., *V. parahaemolyticus*, *V. vulnificus*, *V. cholerae*, *V. fluvialis*, *V. metschnikovii*, *V. mimicus*

Fungi

- *Acremonium* spp. i.e., *A. kiliense*, *A. ricifei*, *A. falsiforme*, *A. strictum*
- *Arthroderma benhamiae/simiti*
- *Aspergillus* spp. i.e., *A. fumigatus*, *A. flavus*, *A. parasiticus*
- *Basidiobolus haptosporus*
- *Blastomyces dermatitidis*
- *Candida* spp. i.e., *C. albicans*, *C. tropicalis*
- *Cryptococcus neoformans* var *gattii* (*Filobasidiella bacillispora*)
- *Curvularia lunata*
- *Dactylaria galopava*
- *Emmonsia parva* var *crescens*, var *parva*
- *Epidermophyton* spp. including: *E. floccosum*
- *Exophiala* spp. i.e., *E. castelani*, *E. dermatitidis*, *E. mansonii*
- *Filobasidiella neoformans*
- *Fonsecaea* spp. i.e., *F. compacta*, *F. pedrosoi*
- *Fusarium coccophilum*
- *Geotrichum candidum*
- *Histoplasma capsulatum*
- *Hortaea werneckii*
- *Leptosphaeria* spp. i.e., *L. senegalensis*, *L. thompkinsii*
- *Loboa lobo*
- *Madurella* spp. i.e., *M. grisea*, *M. mycetomi*
- *Microsporium* spp. i.e., *M. audouinii*, *M. canis*, *M. distortum*, *M. duboisii*, *M. equinum*, *M. ferrugineum*, *M. gallinae*, *M. gypseum*, *M. praecox*, *M. nanum*, *M. persicolor*

- *Monosporium apiospermum*
- *Myrothecium verrucaria*
- *Nannizzia* spp. i.e., *N. gypsea*, *N. obtussa*, *N. otae*
- *Neotestudina rosatii*
- *Paceilomyces lilacinus*
- *Paracoccidioides brasiliensis*
- *Penicillium marneffeii*
- *Phialophora verrucosa*
- *Pseudallescheria boydii*
- *Rhinocladiella* spp. i.e., *R. compacta*, *R. pedrosoi*, *R. spinifera*
- *Rhinosporidium seeberi*
- *Rhizomucor pusillus*
- *Rhizopus* spp. i.e., *R. cohnii*, *R. microsporus*
- *Scedosporium* spp. i.e., *S. apiospermum*, *S. prolificans*
- *Sporothrix schenckii*
- *Trichophyton* spp. i.e., *T. cocciniferum*, *T. equinum*, *T. erinacei*, *T. gourvillii*, *T. megninii*, *T. mentagrophytes*, *T. rubrum*, *T. schoenleinii*, *T. smii*, *T. soudanense*, *T. tonsurans*, *T. verrucosum*, *T. violaceum*, *T. yaoundei*
- *Xylophora carrionii*

Virus

- Adeno-associated viruses (AAV)
- Aino virus
- All isolates of Orthoreovirus and Orbivirus
- Alphaviruses
- Animal adenoviruses
- Animal papillomaviruses
- Animal papillomaviruses
- Astroviruses
- Aura-virus
- Avian viruses. i.e. adenovirus, encephalomyelitis, enterovirus, influenza, poxvirus, retrovirus, encephalomyelitis virus, reticuloendotheliosis virus, smallpox virus, sarcoma virus
- Barmah forest virus
- Batai virus
- Bebaru virus
- Bern-virus
- BK-virus
- Border disease virus
- Bornavirus
- Bovine ephemeral-fever virus
- Bovine foamy virus
- Bovine herpesvirus 2, 3, and 4
- Bovine mucosal disease virus
- Bovine papilloma virus
- Bovine polyomavirus (BPoV)
- Bovine rhinoviruses (types 1-3)
- Breda virus
- Bunyamwera virus
- Cache Valley virus
- Caliciviruses
- California encephalitis virus
- Canine distemper virus
- Canine parvovirus (CPV)
- Chikungunya vaccine strain 181/25
- Chikungunya virus (for studies except vector inoculation, transmission)
- Chimpanzee herpesvirus
- Chuzan virus
- Coltivirus all types including Colorado tick fever virus
- Coxsackie A and B viruses

- Cytomegalovirus
- Dengue virus (for studies except vector inoculation, transmission)
- Drosophila X virus
- Eastern equine encephalomyelitis virus
- Echoviruses - all types
- Ectromelia virus
- Emsliki Forest virus
- Encephalomyocarditis virus (EMC)
- Enterovirus
- Entomopoxviruses
- Equine infectious anemia virus
- Equine influenza virus 1 (H7N7) and 2 (H3N8)
- Equine rhinopneumonitis virus
- Exogenous retroviruses (i.e. murine mammary-tumor virus, feline immunodeficiency virus)
- Feline calicivirus
- Flanders virus
- Fort morgan virus
- Hart Park virus
- Hepatitis A & D
- Herpes simplex types 1
- Herpes zoster
- Human adenoviruses
- Human herpesvirus types 6 and 7
- Human papillomaviruses (HPV)
- Human parvovirus (B 19)
- Human rhinoviruses
- HVJ virus (Sendai virus)
- Infectious Bovine Rhinotracheitis virus (IBR)
- Infectious Bursal diseases of poultry
- Infectious Laryngotracheitis (ILT)
- Influenza viruses - all types except A/PR/8/34, which is in RG 1
- JC virus
- Japanese encephalitis virus (for studies except vector inoculation, transmission)
- Rhinoviruses - all types
- Ross river virus
- Rota virus
- Rubella virus
- Sandfly fever virus
- Shope fibroma virus
- Simian foamy virus
- Simian virus 40
- Simian viruses - all except Herpesvirus simiae (Monkey B virus) & Marburg virus which are in RG4
- Junin virus
- Langat virus
- Lassa virus
- Lumpy Skin Disease (LSD)Virus
- Lumpy skin disease virus
- Lymphocytic choriomeningitis virus (nonneurotropic strains)
- Lymphocytic choriomeningitis virus (nonneurotropic strains)
- Mammalian retrovirus (except HIVm HTLV-1 (ATLV) and HTLV-II)
- Marek's Disease virus
- Measles virus
- Minute virus in mice
- Molluscan contagiosum virus
- Monkey (SV40, SA-12, STMV, LPV)
- Mouse hepatitis virus
- Mouse rotaviruses (EDIM, epizootic diarrhoea of infant mice)

- Mumps virus
- Murine pneumoniae virus
- Myxoma virus
- NDV
- O'nyong-nyong virus
- Orbi virus
- Other avipoxviruses
- Parainfluenza viruses
- Paramyxoviruses
- Parvovirus
- Pichinde virus
- Pixuna virus
- Polio viruses-all types, wild and attenuated
- Polyoma virus
- Porcine adenovirus
- Poxviruses- All types except Alastrim, Monkey pox, Sheep pox and White pox
- Pseudorabies virus
- Rabies (fixed, attenuated) virus
- Rat rotavirus
- Reovirus
- Respiratory syncytial virus
- Reticuloendotheliosis viruses (REV)
- Rhabdoviruses
- Shope fibroma virus
- Simbu virus
- Sindbis virus
- Stomatitis papulosa virus
- Swine vesicular disease virus
- Tensaw virus
- Turlock virus
- Una virus
- Uukuniemi virus
- Vaccinia virus
- Varicella virus
- Venezuelan equine encephalomyelitis vaccine strains TC-83 and V3526
- Vesicular stomatitis virus
- Vesiculovirus
- Yellow fever virus vaccine strain 17D
- Sindibis virus

For Category III and IV refer to DBT Biosafety Guidelines

Annexure IV

IBSC IIT Delhi

Chairman	Director, IIT Delhi
DBT Nominee	Prof. Suman K. Dhar, JNU
External Member	Prof. Rani Gupta, DUSC
Biosafety Officer	Dr. Lily Khosa, Head Hospital Services
Internal Member	Prof. Saroj Mishra, DBEB
Internal Member	Prof. S.K. Khare, Chemistry
Internal Member	Prof. B. Kundu, KSBS
Convener	Prof. Preeti Srivastava, DBEB

For IBSC related forms, visit the DBT website

<https://ibkp.dbtindia.gov.in/Content/ApplicationFormats>

Revision of Faculty Strength at IIT Delhi

Annexure 2

Preamble

IIT Delhi has been declared as an Institution of Eminence (IoE) by Govt. of India in 2018. Moving ahead, the Institute intends to revise the faculty strength of academic units, for which the input of academic units is sought.

The Executive Committee of Senate (ECS), IIT Delhi, in its meeting held on 20.11.2008, approved a methodology to apportion faculty positions amongst departments, centres and schools. This methodology was based on the contribution made by an academic unit in terms of quantum of teaching, number of PhD students, and quantum of sponsored projects and consultancy work. In view of student to faculty ratio of 10:1 given by MHRD, the ECS followed this methodology and recommended 528 faculty strength for 2008-2009 amongst various academic units. Further, the ECS projected sanctioned faculty strength of 776 for 2014-2015, which was then approved by the Board of Governor, IIT Delhi.

Meanwhile, the student strength has increased from around 7750 to about 9670 during the period from 2014-2015 to 2018-2019. Further, new academic units have been established in this period of time and existing units have revised their undergraduate and postgraduate programmes. It is also noted that we are way short of the faculty strength of 776 projected for 2014-2015 even as 2020 has already started¹. It has been decided to relook the sanctioned faculty strength of academic units and the mode of assigning them.

Towards this, the Director has constituted a Faculty Strength Review Committee, comprising of the following members:

1. Prof. Ashok K. Ganguli – Chairperson
2. Prof. T. C. Kandpal – Member
3. Prof. S. G. Deshmukh – Member
4. Prof. Sanjay Mitra – Member
5. Prof. Shantanu Roy – Member
6. Prof. Sudipto Mukherjee – Member
7. Prof. Dipayan Das – Member
8. Dr. Kalyan Kumar Bhattacharjee – Member-Secretary

¹ Currently, faculty strength is 664, including 539 Regular Faculty, 11 Visiting Faculty, 31 Emeritus Faculty, and 83 PDFs.

The committee resolved to ascertain from each academic unit their development goals for the next 2 years, over 5 years, and for the decade, with reference to their current set of activities. Efforts made in this direction for internal and external reviews of academic units held in 2014 and also for IoE activity may be of direct relevance in this regard.

It is said that very large academic units (for example having more than 70 faculty) are not manageable. While expansion of existing academic units is being looked at, there may be a need to create allied academic units, with emphasis which is not central to the existing academic unit. Suggestions regarding such units, reasons for distinction, and merit in developing those units are also sought.

The faculty boards of all academic units are requested to discuss about it. Following deliberations in respective faculty boards, the Heads of all academic units are requested to summarize the data in the proforma and send the same to the Office of Dean (Faculty) by 28th February, 2020 (Friday).

PROFORMA FOR ASSESSMENT OF REQUIREMENT OF FUTURE FACULTY STRENGTH OF ACADEMIC UNIT

Name of Academic Unit : _____

Sl. No.	Items	Current Activity	Projected/Planned Activity		
		As on January 2020	From 2020-2022	From 2022-2025	From 2025 to 2030
1	Current and Future UG & PG Programmes				
1a	Names of UG programmes, total credit requirement for each programme and total strength of students in each programme				
1b	Names of PG programmes, total credit requirement for each programme and total strength of students in each programme				
2	Current and Future Research Areas / Specializations				
2a	Names of research areas/specializations/activities				
2b	Names of major equipments worth of 1 Crore or more to be procured and their individual tentative cost (□) for creation of new research areas/specializations/activities				
2c	Total space (m ²) required to accommodate all major equipments for creation of facilities for new research areas/specializations/activities				
2d	Total tentative cost (□) for creation of new research areas/specializations/activities				

Sl. No.	Items	Current Activity	Projected/Planned Activity		
		As on January 2020	From 2020-2022	From 2022-2025	From 2025 to 2030
3	Current and Future Faculty Members, Staffs and Post-docs				
3a	Number of faculty members in academic unit and their break-up (Regular Faculty/Emeritus Professor/Visiting Faculty/Guest Faculty/Adjunct Faculty/Professor of Practice/Adjunct Professor of Practice/Others)				
3b	Maximum, average, and minimum teaching load of faculty in academic unit (Hours/week)				
3c	Average number of PhD students (full-time and part-time) enrolled per faculty				
3d	Average number of MTech students (full-time and part-time) enrolled per faculty				
3e	Number of staff members (permanent and contractual) in academic unit and its break-up as per designation				
3f	Number of post-doctoral fellows				
4	Any other information towards revision of faculty strength in your academic unit:				

Date:

Place:

Signature of HoD / HoC / HoS

N.B.: Please attach the relevant minutes of meetings of the faculty board along with this document.

Memorandum of Understanding between NITs and IIT Delhi

Scheme for Early Selection of meritorious NIT students to PhD programme

This scheme is intended to enable meritorious National Institute of Technology (NITx) B.Tech. and dual degree M.Tech. students to carry out part of their studies including project work at IIT Delhi and offer an opportunity for direct admission to PhD without the need to qualify GATE or any other national level examination. This will enable “early admission” to PhD for NITx B.Tech. students as early as the end of their 7th semester, and Dual Degree students as early as the end of their 9th semester (after they have completed at least a semester of coursework and project at IITD). It is envisaged that this scheme will also help NIT students to enhance their chances for qualifying for the PMRF fellowship for PhD at IIT Delhi.

Scheme Details

1. Under this scheme, NIT students who have a CGPA of 8.00 at the end of their sixth semester (three years), will be eligible to apply for a project in summer and complete their fourth year (7th and 8th semesters, or either), at IIT Delhi, and then be considered for an early admission into the PhD program at IIT Delhi. Dual Degree students from NITs would be eligible to apply after their 8th semester, for a project in summer, or complete their fifth year (9th and 10th semesters, or either), at IIT Delhi, and then be considered for an early admission into the PhD program at IIT Delhi.
2. There will be two points at which the student can apply, either before May (just after the completion of their 6th semester), and before December (just after the completion of their 7th semester). Correspondingly, this would be at the end of 8th and 9th semester, respectively, for students in the Dual Degree program.
3. Students applying before May would be expected to spend the summer plus the 7th (or 9th) semester in IIT Delhi (which usually spans from late July to the end of November), while students applying before December would be expected to spend their 8th (or 10th) semester in IIT Delhi (which usually spans from late December to early May).

4. All applications will be received through a portal set up for this purpose. They will submit their transcript, and other academic records and achievements, and documentary evidence of any research or internship experience.
5. Upon selection, the students will have a provisional offer of admission to the PhD program. This could be after the completion of the 6th or 7th semester of B. Tech. (or after 8th and 9th semester, respectively, for students in the Dual Degree program). This provisional offer will clearly state that the final offer of admission will follow provided they demonstrate sufficient merit in coursework and/or research during their stay in IIT Delhi. The final confirmation of this offer will be done through a selection committee set up for the purpose, whose decision will be significantly influenced by (but not limited to), the performance of the student in coursework and project conducted at IIT Delhi.
6. Students will actually join the PhD program only after completion of all graduation requirements at NITx, which would be typically in the month of July. All shortlisting criteria and admission criteria must be satisfied by the student at the time of joining as well. Requirement of GATE is waived off, since the student will enter IIT with a minimum CGPA of 8.00.
7. During the stay in IITD, the student will have the status of Visiting Student, and will enjoy all the privileges of a full time student in IIT Delhi.
8. During the stay in IITD, the student may take courses to satisfy the credit requirements for their B. Tech. registration (or Dual Degree) in their parent institution (NITx). IIT Delhi will certify the completion of the courses and the grades obtained in them, and it will be up to NITx to provide credit waiver or transfer the credits as per their academic requirements. The Minor (single semester) or Major (two semester) project can be considered as B.Tech. or M.Tech. projects (or parts thereof), by the respective parent NIT (as per their own policy on projects).
9. In all academic/project work undertaken here in IIT Delhi, transcript will be provided with relevant credits. Consideration of these credits by individual NITs will be up to the respective institution. Students may also undertake additional credits as Pre-Ph.D. courses for their PhD program, during their stay (in a regular semester) at IIT Delhi.
10. During their stay in IIT Delhi as a Visiting Student, IITD will not be charging any academic fees to the student, except fixed charges as applicable, since these students will be paying

their regular academic fees in their parent institution. Being B.Tech./ Dual Degree students, IITD will be providing either on-campus or off-campus hostel accommodation during the one-year period. Hostel fees will be charged at regular rates.

11. Even after getting the confirmed offer of admission, the student (with prior permission of NITx, and on application to IITD) may continue to stay for one more semester doing coursework and/or project at IITD.
12. Students coming under this program will not be entitled for participation in the Training & Placement process in IIT Delhi, until they register as full-time PhD students. This will be clearly stated in their provisional offer of admission.
13. As part of this program, students can have the following academic windows at IIT Delhi:
 - (i) Summer (after 6th semester) plus 7th semester (summer after 8th semester plus 9th semester, for Dual Degree);
 - (ii) Only 7th semester (9th semester for Dual Degree);
 - (iii) Only 8th semester (10th semester for Dual Degree);
 - (iv) Summer (after 6th semester) plus 7th and 8th semesters (summer after 8th semester plus 9th and 10th semesters, for Dual Degree);
 - (v) 7th and 8th semesters (9th and 10th semesters, for Dual Degree).