Dissertation

In

Jaypee Hospital, Noida

(February 1 – May 1, 2012)

"Setting-up of Laboratory Services in a 100 Bedded Hospital and also proposing the best model for equipment acquisition"

Kanishak Gautam

Post-graduate Programme in Hospital & Health Management

2011-13

IIHMR DELHI

JAYPEE
Healthcare Limited

Certificate of Internship Completion

Date 15th May, 2013

TO WHOM IT MAY CONCERN

This is to certify that Mr. Kanishak Gautam has successfully completed his 3 months internship in our organization from February 01, 2013 to April 30, 2013. During this internship he has worked on the "Setting up of laboratory Services in a 200 Bedded Hospital and Also Proposing The Best Model For Equipment Acquisition" under the guidance of Operations team at Jaypee Hospital, Noida.

We wish him good luck for her. future assignments.

Sonya Tandon
DGM-HR
Jaypee Hospital, Noida

Certificate from Dissertation Advisory Committee

This is to certify that **Mr Kanishak Gautam**, a graduate student of the **Post- Graduate Diploma in Health and Hospital Management**, has worked under our guidance and supervision. She is submitting this dissertation titled **"To carry out a detailed study on setting-up of Pathology Services in a 100 Bedded Hospital and also proposing the best model for equipment acquisition"** in partial fulfilment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management.**
This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

17/05/13

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Certificate of Approval

The following dissertation titled " **To carry out a detailed study on setting-up of Pathology Services in a 100 Bedded Hospital and also proposing the best model for equipment acquisition**" is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **Post- Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation

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Mrs. Kirti Udayai	17/5/13
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FEEDBACK FORM

Name of the Student: Mr. Kanishak Gautam

Dissertation Organisation: Jaypee Hospital (Jaypee Healthcare Ltd.)

Area of Dissertation: Hospital Operations

Attendance: 100%

Objectives achieved: Achieved

Deliverables: "Setting - up of laboratory services in a 200 - Bedded hospital and also proposing the cost-model for equipment Acquisition".

Strengths: Hard Working, Focused, Smart, Neat.

Suggestions for Improvement: Needs to be more focused.

Signature of the Officer-in-Charge/ Organisation Mentor (Dissertation)

Date: 30.04.2013
Place: Noida

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ABBREVIATIONS

CTVS – Cardio Thoracic Vascular Surgery

ICU – Intensive Care Unit

OBG – Obstetrics & Gynaecology

OPD – Out Patient Department

OP – Out Patient

ENT – Ear Nose and Throat

COE – Centre of Excellence

EHC – Executive Health Check-up

MICU – Medical ICU

SICU – Surgical ICU

NICU – Neonatal ICU

CCU – Cardiac Care Unit

OT – Operation Theatre

RRA – Rental Reagent Agreement

GI – Gastrointestinal

HP – Himachal Pradesh

ICCU – Intensive Cardiac Care Unit

IVF – In-vitro Fertilization

AHU – Air Handling Unit

PTS – Pneumatic Tube System

MEP – Mechanical Engineering & Plumbing

LDR – Labor & Delivery

CSSD – Central Sterile Supply Department

RO – Reverse Osmosis

BEP – Break Even Point

ALOS – Average Length of Stay

PV – Profit Volume Ratio

ACKNOWLEDGEMENT

Words can never be enough to express my sincere thanks to Hospital Operations Team and especially **Mr. Gaurav Anand, Deputy Head – Operations**, Jaypee Hospital Noida for his continuous guidance and support.

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In the end, I am thankful from the core of my heart to my beloved parents and Sushet Gautam, my brother who supported me throughout the course of study. Last but not the least; I am thankful to all the colleagues for their help and cooperation.

Kanishak Gautam

PGDHHM

Batch – D

2011 - 2013

Dissertation Report

HOSPITAL PROFILE

ABOUT JAYPEE GROUP

- The Jaypee Group is a 15,000 Crore well diversified infrastructural industrial conglomerate in India.
- Shri. Jaiprakash Gaur, Founder Chairman of Jaiprakash Associates Limited after acquiring a Diploma in Civil Engineering in 1950 from the University of Roorkee (now Indian Institute of Technology Roorkee), had a stint with Govt. of U.P. and branched off on his own, to start as a civil contractor in 1958, group is the 3rd largest cement producer in the country
- Jaypee Group is five a decade old conglomerate based in Noida, India, involved in various industries that include Engineering, construction , Cement, Power, Hospitality, Real Estate, Expressways, Highways, Education and Social Commitment.

Figure 1 : Prototype of Jaypee Hospital

- The groups cement facilities are located today all over India in 10 states, with 18 plants having an aggregate cement production capacity of 36 Million Tonnes.

SPREAD OF THE COMPANY

CEMENT

- Jaypee Group is the 3rd largest cement producer in the country. The group produces special blend of Portland Pozzolana Cement under the brand name 'Jaypee Cement' (PPC). The company is in the midst of capacity expansion of its cement business in Northern, Southern, Central, Eastern and Western parts of the country and is slated to be 35.90 MnTPA by FY13 (expected) with Captive Thermal Power plants totalling 672 MW

ENGINEERING & CONSTRUCTION

- The Engineering and Construction wing of the Group is an acknowledged leader in the construction of multi-purpose River Valley and Hydropower projects. It has the unique distinction of having simultaneously executed 13 Hydropower projects spread across 6 states and the neighbouring country Bhutan for generating 10,290 MW power

SPORTS

- The Group finished the construction and execution of India's first ever F1 Grand Prix on 30th October, 2011. In addition to F1, the track will also host other top-level international motorsports events from 2012 onwards.

HOSPITALITY

- The Group's hospitality business owns and operates 6 properties spread across New Delhi, Uttar Pradesh and Uttarakhand. The 4 Five Star Hotels, two in New Delhi and one each in Agra and Missouri have a total capacity of 644 rooms.

EDUCATION

- "People of resources must contribute towards making a better tomorrow for all". Shri Jaiprakash Gaur ji, Founder Chairman of the Group firmly believes that quality education on an affordable basis is the biggest service which, as a corporate citizen, we can provide. Education is the cornerstone to economic development and the

strength of 1 billion Indians can be channelized by education alone to build India into a developed nation.

REAL ESTATE AND EXPRESSWAYS

- The Group is a pioneer in the development of India's first golf centric Real Estate. Jaypee Greens - a world class fully integrated complex consists of an 18 hole Greg Norman Golf Course. Stretching over 452 acres, it also includes residences, commercial spaces, corporate park, entertainment and nature in abundance. Jaypee Greens also launched its second project in Noida in November 2007. India's First Wish Town, is an Integrated Township spread over 1162 acres of land comprising one 18 hole and two 9 hole golf facility & world class residences.

SOCIAL COMMITMENTS

- The Group has always believed in "growth with a human face" and to fulfil its obligations it has set up Jaiprakash Sewa Sansthan (JSS), a 'not-for-profit trust' which primarily serves the objectives of socio – economic development, reducing the pain and distress in society. For over 4 decades now, Jaypee Group has supported the socio-economic development of the local environment in which it operates and ensured that the economically and educationally challenged strata around the work surroundings are also benefited from the Group's growth by providing education, medical and other facilities for local development .

LEADERSHIP TEAM

Figure 2 : Leadership Team

***THE LOGO OF JAYPEE HOSPITAL*:**

Figure 3 : Logo

- **The leaf** represents that we are environment friendly and follow medication safety. The sharp edges and corners represent the modern side (cutting edge technology and world class infrastructure) and the rounded corners represent the patient-care side of Jaypee Hospital.
- **The Blue in Jaypee** is identified with Confidence, Credibility and Competence, represents Jaypee Medical Hospital's multi-disciplinary capability, cutting edge technology and service foundation built on world-class infrastructure and processes.
- **The Orange** represents the vibrancy, high energy and 'let's make it happen' attitude of our people.

- **The Orange in leaf and Hospital** represents that we are a New Life in the group which is supported by Blue Leafs and J of Jaypee Group as pillar of strength.

VISION

"Promoting healthcare to the common masses with the growing needs of society by providing quality and affordable medical care with commitment"

-Founder Chairman's Vision on Healthcare

MISSION

"The Jaypee Group is committed to meet the healthcare needs of the population in Noida and the surrounding regions through building Jaypee Hospital as a super specialty hospital with advanced healthcare facilities, the latest diagnostic services, and state-of-the-art technology focused on medical specialties that meet the needs of the population. The Jaypee Hospital will be the ultimate choice for medical care."

JAYPEE GROUP –HEALTHCARE PHILOSOPHY

- Three Secondary care medical facilities currently operational at –Bhutan, Rewa (M.P) & Baspa (H.P) providing care to approximately One million lives treated annually.
- Other Healthcare Initiatives - Medical Camps, Pulse Polio Camps, Maternity camps, Health Checkup of Village Children, Health & Hygiene Awareness Camps
- Mobile Medical Van (with Lab and other diagnostic facilities) Diagnosis and medicine distribution free of cost (about 100 patients per day).

PILLARS OF JAYPEE MEDICAL HOSPITAL

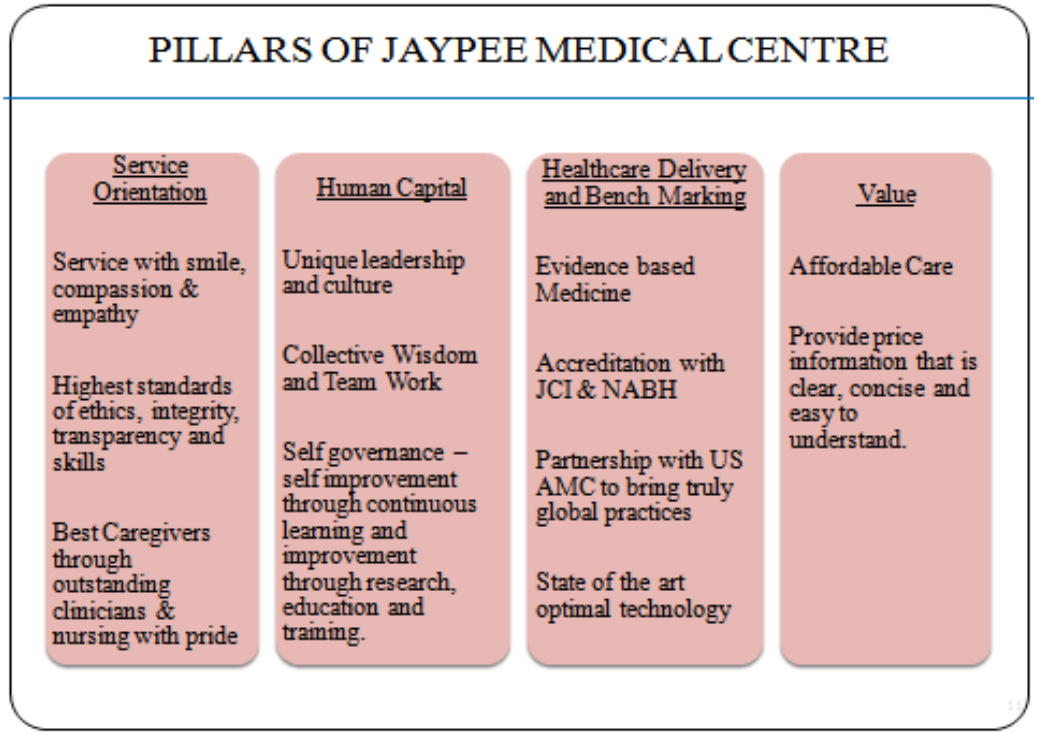

Figure 4 : Pillars of Jaypee Hospital

OVERVIEW OF JAYPEE HOSPITAL

- Flagship Hospital of the Jaypee Group
- Spread over 110000 Square Meters of campus
- Total Beds: 1000 beds. (505 Beds in Phase 1)
- Proposed Nursing School on campus
- Would be a LEED Certified building
- Would target for Joint Commission International accreditation in first year

SERVICES TO BE OFFERED

Figure 5 : Services to be offered

Table Number 1: FLOOR WISE DEPARTMENTAL PLANNING

Sl. No.	FLOOR	DEPARTMENTS
1	Seventh	Wards
2	Sixth	Wards
3	Fifth	Wards
4	Service	IT Server, AHU, PTS station and MEP
5	Fourth	OT Complex, ICCU, Cath lab.
6	Third	Economy Bed, IVF, MICU, SICU, NICU, LDR
7	Second	Chemotherapy, Cosmetology, Endoscopy, Physiotherapy, Paediatric, Office.
8	First	Behavioural science, Ortho. , Neuro. , Gen. Surgery/MAS, Pulmonology, Opthal. , Dental, ENT, Diabetes Cardiac.
9	Ground	Executive Health Check up, Dialysis, Radiology, Day care, Emergency and Trauma, Pharmacy.
10	Upper basement	Blood Bank, Pathology Laboratory, Nuclear medicine, Kitchen, Administration.
11	Lower basement	Bio-medical Eng., Radiation Oncology, Laundry, Mortuary, CSSD.

Rationale of Study

The rapid growth in science and technology has touched every sphere of our life bringing about automation and sophistication. Healthcare delivery process, due to the giant leaps in technology, is getting more and more mechanised. Newer diagnostic investigations, techniques and equipments are knocking our doors. Steep technological changes have been witnessed by laboratory department. Not only is there a change in the manner how investigations are carried out and reported but also there are new and advanced equipments available in the market. These equipments come with a very high cost.

The initial cost of purchase of equipment is very high. Options now days are available with Hospitals to reduce this high initial cost and set up laboratories to provide good and timely diagnostic services. One of the methods of bypassing this cost is installing the equipment through a rental reagent model rather than purchasing it. This study aims at checking out the viability of this model as far as acquisition of equipments for the Hospital Laboratory Services are concerned.

Review of Literature

These are some of the studies and publications on Acquisition of Laboratory equipments:

1) Armbuster DA published a study on "Reagent lease/rental agreements: an alternative to instrument purchase. Acquire a state-of-the-art analyzer more quickly and easily": A primary responsibility of the laboratory manager is to obtain analytical instrumentation for his or her facility. Traditionally, analyzers are purchased as capital investments. An increasingly popular alternative is the reagent lease/rental agreement. A manufacturer provides a laboratory with an analyzer with the provision that the laboratory will purchase the reagents from the manufacturer. Reagents are purchased at a set cost per test, which varies with test volume, and this price incorporates a charge for the use of the instrument. The laboratory manager can acquire a state-of-the-art analyzer more quickly and easily than through a purchase and can maintain the flexibility to switch to a more suitable system as technology and service requirements change. Significant advantages and disadvantages accrue to both the laboratory and the manufacturer. The reagent lease/rental agreement is an option definitely worth considering by laboratory managers.

2) Pols AL published a study on "Negotiating optimum capital equipment acquisitions": Healthcare organizations planning capital equipment acquisitions should negotiate with more than one equipment vendor and determine the equipment purchase price, service agreement price, and financing or leasing option rate separately to avoid hidden costs. The purchase price should be negotiated first. A long-term service agreement should be locked in, or service insurance purchased, for the length of the financing or lease agreement. The equipment vendor's financing agreement should be compared with offers from third parties, who may have more beneficial financing options or more flexible lease arrangements.

3) Campbell CA, Kelly T Jr published a study on "Equipment leasing: are you overlooking what may be your best financing option?": In this era of increasingly scarce resources, it is imperative that decision makers choose alternatives that are the most efficient and effective use of the resources available. In terms of equipment acquisition, this means not only selecting the right equipment but also choosing the best method of financing the acquisition. Leasing is one alternative that may be the most efficient and effective use of capital. Health information managers should have a

basic understanding of the factors to be considered when evaluating the lease vs. purchase alternative. In the competition for increasingly scarce resources, knowing how to present alternatives to the decision makers can make the difference between denial and approval of equipment acquisitions for the health information department.

Objectives

***General Objective*:**

To carry out a detailed study on setting-up of Laboratory Services in a 200 Bedded Hospital and also proposing the best model for acquisition of equipment

Specific Objectives:

- To define the Scope of Laboratory Services
- To map the resources requirement for the department
- To calculate the Capital & Operational cost involved in the Laboratory Services
- To calculate the Net Present Value and Pay Back Period for the laboratory services.
- To recommend the model to be adopted for acquiring equipments for the Hospital

Study Assumptions

The proposed Hospital project would have 163 beds with facilities to provide high-end secondary care treatment. The Hospital would need a building space of 1, 27,500 sq. ft approximately with space for future expansion. There will be Five operating rooms (with major & minor categorization), catering to CTVS, Orthopedics, Gynecological, General Surgery, day care procedures, and trauma surgical workload. The Hospital will also have exclusive ICU beds for medical, surgical, neonatal & pediatrics, facility for pre operative & post operative beds, triage for observation to handle emergency cases.

The Hospital will provide round-the-clock services in emergency, cardiology, orthopaedics, OBG, Paediatrics and other medical services. The Hospital with the state-of-the-art medical technology and skilled personnel will provide a congenial infrastructure for the medical professionals to offer healthcare of international standards.

The hospital would have approximately 20 to 25 consultation suites cum examination room, for accommodating a number of Consultants of all departments for outpatients. Appropriate areas for residents to work up patients would be provided in the OPD block. OPD would be supported by treatment / plaster rooms, OP facilities in Ophthalmology, ENT, Dermatology, Dentistry etc.

Departments

Major specialties are listed below. The clinical departments have been planned as under,

COE	**Other Departments**	**Support Infrastructure**
❑ Cardiology	❑ Dentistry	❑ Laboratory Services
❑ Orthopaedics	❑ ENT	❑ Radiology & Imaging services
❑ Emergency & Trauma	❑ General Surgery	❑ Physiotherapy
❑ Obstetrics & Gynaecology	❑ Internal Medicine	❑ Round the clock ambulance services
❑ Critical Care	❑ Neonatology	❑ 24 hours pharmacy
	❑ Urology/ Nephrology	
	❑ Ophthalmology	
	❑ Paediatrics	
	❑ Chest Medicine	
	❑ EHC	

Classification of Beds

The inpatient beds are grouped into following categories taking into consideration the composition of the patient load vis-à-vis their affordability and also estimated requirement of critical care and emergencies

Table Number 2: Classifications of Beds

BEDS CLASSIFICATION	**Beds**
	Phase-I
Revenue Beds	
Suite	2
Deluxe/ Private Beds	36
Twin Sharing Beds	28
General Ward (4 bedded bay)	16
MICU / SICU / NICU / CCU	37
Support Beds	
Pre & Post Operative ward	10
Pre and Post Cath	10
Labor recovery	2
Nursery	2
Dialysis ward	6
Daycare wards	10
Emergency and Casualty	**6**
TOTAL HOSPITAL BEDS	163

Operating Theatre	
Major Theatre (CTVS – 1, Ortho/Neuro – 1, General – 1)	3
Minor Theatre (including Emergency OT)	1
C-Section theatre	1

Intensive Care Unit

- ICU forms the backbone of any hospital. For the proposed hospital, the ICU beds accounts for nearly 22% of the total hospital beds.

The infrastructure, utilities and hospital facilities would be designed with utmost consideration to optimize with minimum capital cost and lowest operational cost. The end result would be to provide most advanced and effective patient care to all types of cases in a most affordable manner.

Out Patient (OP) Department

- The estimated daily OP activity for the hospital at the rate of 100% utilization will be approximately 400.
- The old and new cases are considered at the rate of 75 and 25 percentages of the total cases respectively.
- OPD will function for 310 days and 8 hours per day.
- The total numbers of consultant suites will be 20

Support Services

- 24 hours 7 days a week fully functional Emergency Care Unit
- High-end Critical Care Units with sophisticated life support equipments

- Dedicated Laboratory Services (Biochemistry, Hematology, Microbiology)
- Radiology & Imaging Science, with spiral CT, X-Ray
- Operation Theatres (General) – 3 nos.
- Maternity Theatre -1 no.
- Health Check up packages
- Round the clock Pharmacy
- Renal Dialysis

The Hospital shall have all important supporting service inclusive of water treatment plant, sewage treatment plant, power & electrical infrastructure with back up of generators & UPS, medical gas manifolds to ensure efficient functioning and offer high quality patient-friendly-care in terms of cleanliness, reliability, efficient nursing care and speedy service.

The above listing is not exhaustive, but covers almost the entire gamut of facilities required in a Hospital of this nature. The equipment requirement will be arrived at based on the patients flow envisaged for different disciplines, utilization pattern, latest technology, scope for up gradation and effective servicing. Essential service such as power, medical gas, sterile and comfortable environment will also be provided as per the requirement. A projected sales plan for path lab has been proposed according to the service facility mix and the market survey.

Methodology

Study Design:

Descriptive study

Study Population:

Hospital staff

Clinicians

Pathology Laboratory Equipment Vendors

Sample and Sample Design:

Convenience sampling for Laboratory vendors

4 Vendors, it was based on quotes received from different vendors for capital equipment and their proposal for rental reagent agreement.

Data Collection tools and techniques:

Tools **–** Checklist

Techniques **–** In-depth Interviews of clinicians, Vendors and Laboratory Staff

Study Findings

A list of all the laboratory investigations which would be conducted was prepared based on the available specialities and services. This list was further divided into a mix of the Laboratory departments. The departments planned include:

- Biochemistry
- Histopathology
- Haematology
- Microbiology

A list of 180 investigations was finalised for all these departments and to conduct all these investigations, equipments were listed, taking into account their throughput and the range of test that can be conducted by them. The list of tests to be performed is attached as an annexure. Based on which the equipments required were listed:

TABLE NUMBER 3: LISTS OF EQUIPMENTS

Department	*Equipments*	*Qty*
Biochemistry	Immuno assay	1
	ABG Machine	1
	RO System	1
	Bio Chemistry Analyser (Fully Automatic)	1
	Electrolyte Analyser	1
	Centrifuge	1
Histopathology	Embedding Station	1
	Tissue flotation Bath	1
	Warm water Bath	1
	Wax Dispenser	1
	Slide warming Table	1
	Microtome	1
	Cyto centrifuge	1
	Automatic Tissue Processor	1
	Grossing Station	1
Haematology	Automate Haematology Analyzer	1
	Coagulation Analyzer	1

	Micro Scope	1
	Cyclo Mixer	1
Microbiology	Microbiology Analyzer	1
	Bio Safety Cabinet	1
	Serological Water Bath	1
	Incubator Universal	1
	Bacteria Analyzer	1
	Micro Scope	1
	Laminar Air flow Bench	1
	Vertical Autoclave	1
	Loop Sterilizer	1
	Oven	1
	Centrifuge	1

The equipments listed above can be acquired by one of the two ways:

- Rental Reagent Agreement
- Purchase of Equipment

The basic difference between the two lies in the fact that for Rental Reagent agreement, lower capital cost is required to purchase and install the equipments, as the ownership of the equipments lies with the provider supplying the equipment. The capital investment is quite high in case of Capital purchase model as the cost of equipments has to be paid for and the ownership lies with the Hospital. The reagent cost for purchased equipment is on a lower side when compared to a rental reagent model as for the rental reagent there is an agreement to purchase reagent amounting to a fixed cost every month which escalates the operational cost manifolds. This difference between the costs was acknowledged when the comparative pricing was conducted for the above mentioned list of equipments. The lowest prices in both the cases were considered and capital cost was drawn which amounted as under:

TABLE NUMBER 4: CAPITAL INVESTMENTS FOR RENTAL REAGENT AGREEMENT

Department	*Equipments*	*Qty*	*Cost (in Rs. Lakhs)*
Biochemistry	Immuno assay	1	RRA
	ABG Machine	1	RRA
	RO System	1	Centralised
	Bio Chemistry Analyser	2	RRA
	Electrolyte Analyser	1	2
	Centrifuge	1	0.40
Histopathology	Embedding Station	1	7.75
	Tissue flotation Bath	1	0.57
	Warm water Bath	1	0.57
	Wax Dispenser	1	0.20
	Slide warming Table	1	0.25
	Microtome	1	11.93
	Cyto centrifuge	1	0.15
	Automatic Tissue Processor	1	8.79
	Grossing Station	1	0.22
Haematology	Automate Haematology Analyzer	2	RRA
	Coagulation Analyzer	1	RRA
	Micro Scope	1	1
	Cyclo Mixer	1	0.50
Microbiology	Microbiology Analyzer	1	30
	Serological Water Bath	1	0.57
	Incubator Universal	2	0.42
	Bacteria Analyzer	1	20
	Micro Scope	1	1
	Laminar Air flow Bench	1	3
	Vertical Autoclave	1	0.80
	Loop Sterilizer	1	0.20
	Oven	1	0.30
	Centrifuge	1	1
	Total Capital Cost (RRA)		**Rs. 91.62 Lakhs**

TABLE NUMBER 5: CAPITAL INVESTMENTS FOR TOTAL PURCHASE

Department	*Equipments*	*Qty*	*Cost (in Rs. Lakhs)*
Biochemistry	Immuno assay	1	12
	ABG Machine	1	5.5
	RO System	1	Centralised
	Bio Chemistry Analyser (Fully Automatic)	1	40
	Electrolyte Analyser	1	2
	Centrifuge	1	0.40
Histopathology	Embedding Station	1	7.75
	Tissue flotation Bath	1	0.57
	Warm water Bath	1	0.57
	Wax Dispenser	1	0.20
	Slide warming Table	1	0.25
	Microtome	1	11.93
	Cyto centrifuge	1	0.15
	Automatic Tissue Processor	1	8.79
	Grossing Station	1	0.22
Haematology	Automate Haematology Analyzer	1	25
	Coagulation Analyzer	1	40
	Micro Scope	1	1
	Cyclo Mixer	1	0.50
Microbiology	Microbiology Analyzer	1	30
	Serological Water Bath	1	0.57
	Incubator Universal	1	0.42
	Bacteria Analyzer	1	20
	Micro Scope	1	1
	Laminar Air flow Bench	1	3
	Vertical Autoclave	1	0.80
	Loop Sterilizer	1	0.20
	Oven	1	0.30
	Centrifuge	1	1

Capital Cost (Total Purchase) **Rs. 214.12 Lakhs**

Operational Cost

To take into account the resources required for operational laboratory services, Operational cost forms a very important head which can broadly be classified into three major heads:

- Manpower Cost
- Reagent Cost
- Utility Cost (Electricity Cost)

Let us calculate the operational cost by calculating the three different heads.

Manpower cost can be worked out in the following manner:

TABLE NUMBER 6: MANPOWER COST

S. No	Department	Numbers	Cost (in Rs. Lakhs)
1	Biochemistry	2	6
2	Histopathology	3	9
3	Hematology	2	6
4	Microbiology	2	6
5	General Shift	1	4.8
6	Night Shift	1	3
7	Relievers	2	6
8	Consultant HOD	1	24
9	Part time Specialist Doctor	1	6
	Total Budget		**70.8**

Reagent cost differs both in the case of Rental Reagent Agreement and Purchase of equipments, which can be calculated as:

TABLE NUMBER 7: REAGENT COST FOR RENTAL REAGENT AGREEMENT

S.No	Equipment	Price (in Rs. Lakhs)
1	Biochemistry Analyzer (RRA)	30
2	Electrolyte Analyzer	12
2	Immuno assay (RRA)	24
3	ABG Machine (RRA)	6
4	Automatic Tissue Processor	0.64
5	Hematology Analyzer (RRA)	30
6	Coagulation analyzer (RRA)	3
7	Microbiology Analyzer	0.78
8	Bacteria Analyzer	0.67
	Total Price	**107.09**

TABLE NUMBER 8: REAGENT COST FOR TOTAL EQUIPMENT PURCHASE

S.No	Equipment	Price of reagent (in Rs. Lakhs)
1	Biochemistry Analyzer	16
2	Electrolyte Analyzer	8.2
2	Immuno assay	14
3	ABG Machine	3.5
4	Automatic Tissue Processor	1.64
5	Hematology Analyzer	17
6	Coagulation analyzer	2.2
7	Microbiology Analyzer	1.78
8	Bacteria Analyzer	1.67
	Total Price	**64.99**

Utility cost includes the cost of consumption of electricity which can be calculated as:

TABLE NUMBER 9: ELECTRIC LOAD CALCULATIONS

Department	*Equipments*	*Electric load (Kva)*
Biochemistry	Immuno assay	2.5
	ABG Machine	1
	RO System	Centralized
	Bio Chemistry Analyzer (Fully Automatic)	2
	Electrolyte Analyzer	1
	Centrifuge	1
Histopathology	Embedding Station	0.5
	Tissue flotation Bath	0.2
	Warm water Bath	0.2
	Wax Dispenser	1
	Slide warming Table	0.1
	Microtome	1
	Cyto centrifuge	1
	Automatic Tissue Processor	0.2
	Grossing Station	0.1
Hematology	Automate Hematology Analyzer	2
	Coagulation Analyzer	1
	Micro Scope	0.1
	Cyclo Mixer	0.5
	Microbiology Analyzer	1
	Bio Safety Cabinet	0.2
	Serological Water Bath	0.1

Microbiology	Incubator Universal	1
	Bacteria Analyzer	3
	Micro Scope	0.1
	Laminar Air flow Bench	0.2
	Vertical Autoclave	4
	Loop Sterilizer	0.2
	Oven	1
	Centrifuge	1
	Total load	**27.2**

27.2 KvA load consumes wattage of 21.76 KWatts and hence the cost of electricity can be worked out using the following formulae:

Wattage x Hours Used / 1000 x price per unit = Cost of Electricity

The cost of electricity comes out to be: Rs. 19. 06 Lakhs

Interest Amount:

Acquiring equipments through Rental Reagent Model involves a Capital Cost of Rs. 91.62 Lakhs. The cost would be divided into two shares of 50% each as follows:

Rs. 45,81,000 – To be Paid by the Hospital

Rs. 45,81,000 – Financed by the Bank

The interest rate for the financed amount is chargeable by 11% p.a. and amounts to be:

11 % of Rs. 4581000 = Rs. 503910 = Rs. 5.03 L

Purchasing all the equipments involves a Capital Cost of Rs. 214.12 Lakhs. The cost would be divided into two shares as follows:

Rs. 1,07,06,000 – To be Paid by the Hospital

Rs. 1,07,06,000 – Financed by the Bank

The interest rate for the financed amount is chargeable by 11% p.a. and amounts to be:

11 % of Rs. 1,07,06,000 = Rs. 1177660 = Rs. 11.77 L

TOTAL INVESTMENT:

The sum of all the above cost heads gives us the budget for the setting-up and operational cost for laboratory services which can be summed as under:

For Rental Reagent Agreement:

TABLE NUMBER 10: TOTAL COST FOLLOWING RENTAL REAGENT AGREEMENT

S. No	Details	Cost (in Rs. Lakhs)
1	Capital Cost	91.62
2	Reagent Cost	107.09
3	Utility Cost	19.06
4	Manpower Cost	70.80
5	Interest Amount	3.66
	Total Cost	**286.51**

For Capital purchase:

TABLE NUMBER 11: TOTAL COST FOLLOWING TOTAL CAPITAL PURCHASE

S. No	Details	Cost (in Rs. Lakhs)
1	Capital Cost	214.12
2	Reagent Cost	56.99
3	Utility Cost	19.06
4	Manpower Cost	70.80
5	Interest Amount	16.05
	Total Cost	**371.30**

Forecasting of Sales Figures:

Based on the OPD footfall worked out and inpatient admissions, the following number of cases are expected to be the case load on the following departments, out of which the case load and hence the revenue of laboratory department has been worked out. The table below depicts case loads per speciality and hence the revenue of laboratory has been calculated, keeping in mind:

- Type and mix of investigations

- Number of investigations
- Price of investigations
- Frequency of investigations

The yearly sales percentage has also been worked out as what is planned and has to be achieved, which starts from 60% in the year 1 to 90% in the year 5.

Calculation of these sales figures will facilitate the process of calculation of Break Even Point and hence the payback period working out a conclusion as to what mix should be followed for the procurement of equipments.

TABLE NUMBER 12: PROJECTED SALES FIGURES

	Product	Daily Cases	Work Volume X No. of days	Rate (Lacs)	Cases / year	Total (Lacs)	Year 1	Year 2	Year 3	Year 4	Year 5
							60%	70%	80%	85%	90%
A	**Gen surg**										
1	Major (ALSO - 6)	1	280	0.01	280	3	2	2	2	2	3
2	Medium (ALSO - 3)	2	280	0.01	560	6	4	4	4	5	5
3	Minor Surgery	2	320	0.01	640	6	2	2	5	5	6
						15	**7**	**8**	**12**	**13**	**13**
B	**Cardiology**	2	280	0.02	560	**11**	**7**	**8**	**9**	**10**	**10**
C	ICU Admission	6	365	0.02	2190	**44**	**26**	**31**	**35**	**37**	**39**
D	**Gynaecology**										
1	Birthing	2	320	0.01	640	7	4	5	6	6	6
2	Caeserean section	1	320	0.01	320	4	2	2	3	3	3
3	Gynec surgery (ALOS 4)	1	280	0.01	280	3	2	2	2	3	3
						14	**8**	**10**	**11**	**12**	**12**
E	Internal Medicine	10	365	0.01	11200	**112**	**67.2**	**78.4**	**89.6**	**95.2**	**100.8**
F	Path Lab (OPD)	100	280	0.00	28000	**56**	**34**	**39**	**45**	**48**	**50**
G	EHC	15	300	0.02	4500	**90**	**54**	**63**	**72**	**77**	**81**
H	**Gross Sales**					**341**	**203**	**237**	**273**	**290**	**307**

Net Present Value

After calculating the figures of Capital and Operational budget of Laboratory services and projecting the sales figures for the same, the calculation of net present value is the next step to justify the mode or mix as to how the procurement should be done. Net present value has to be calculated separately for both the arrangements i.e. for Rental Reagent Agreement model and for purchase of equipments which will come in handy to propose a model for acquiring the equipments for the laboratory setup of the hospital.

The Net present value calculated for Rental Reagent Agreement of equipments is as under:

TABLE NUMBER 13: CALCULATION OF NPV OF RENTAL REAGENT AGREEMENT

		Y0	Y1	Y2	Y3	Y4	Y5
Capital Cost		91.12					
Sales			203	237	273	290	307
Operational Cost							
Manpower Cost			70.8	70.8	70.8	70.8	70.8
Reagent Cost			107.09	117.799	129.5789	142.5368	156.7905
Utility Cost			19.06	19.06	19.06	19.06	19.06
AMC/CMC			-	-	-	-	-
GROSS PROFIT			6.05	29.341	53.5611	57.60321	60.34953
Interest			5.01	4.01	3.01	2.01	1
Net profit			1.04	25.33	50.55	55.59	59.35
Tax @30%			0.312	7.5993	15.16533	16.67796	17.80486
Tax Saving on Depreciation			5.4672	5.4672	5.4672	5.4672	5.4672
PAT			6.20	23.20	40.85	44.38	47.01
PVF@ 11%		1	0.9	0.811	0.731	0.658	0.593
PV amount		-91.12	5.57568	18.81431	29.86352	29.20365	27.87804
NPV		**20.22**					
Working on Tax Saving on Depreciation							
Depreciation	18.224		18.224	18.224	18.224	18.224	18.224
Tax Savings	5.4672		5.4672	5.4672	5.4672	5.4672	5.4672

The Net present value calculated for Capital Purchase of equipments is as under:

TABLE NUMBER 14: CALCULATION OF NPV OF CAPITAL PURCHASE MODEL

	Y0	Y1	Y2	Y3	Y4	Y5
Capital Cost	214.12					
Sales		203	237	273	290	307
Operational Cost						
Manpower Cost		70.8	70.8	70.8	70.8	70.8
Reagent Cost		64.99	71.489	78.6379	86.50169	95.15186
Utility Cost		19.06	19.06	19.06	19.06	19.06
AMC/CMC		3.85	4.28	5.3	6.42	10.7
GROSS PROFIT		44.3	71.371	99.2021	107.2183	111.2881
Interest		11.77	9.42	7.07	4.72	2.37
Net profit		32.53	61.951	92.1321	102.4983	108.9181
Tax @30%		9.759	18.5853	27.63963	30.74949	32.67544
Tax Saving on Depreciation		6.4236	6.4236	6.4236	6.4236	6.4236
PAT		29.1946	49.7893	70.916.7	78.17242	82.6663
PVF@ 11%	1	0.9	0.811	0.731	0.658	0.539
PV amount	214.12	26.27514	40.37912	51.83965	51.43745	49.02112
NPV	**4.83**					
Working on Tax Saving on Depreciation						
Depreciation		21.412	21.412	21.412	21.412	21.412
Tax Savings		6.4236	6.4236	6.4236	6.4236	6.4236

Conclusion and Recommendations

The detailed account on the costing, NPV has helped us derive conclusions regarding the mode of acquisition as to how equipments should be procured. The following points were drawn:

- Clearly, the NPV calculations depict that Rental Reagent agreement is a better method for acquisition of equipments because its NPV is better than Capital Purchase model which helps us to measures the excess of cash flows in present value terms.
- The acquisition should follow a mix wherein the equipments to be procured should be a mix of both Rental Reagent Agreement and Purchase of certain items.
- The proposed model for Rental Reagent Agreement is hence the best suited for acquisition of equipments.

Limitations

The study though was conducted with an effort and intent to draw inferences and results which are as close to real time situations as possible but it did have a few limitations stated as under:

- The Hospital facility was non operational and hence the patient load and trends of working of facility were totally on the basis of established thumb rules as no related data was available.
- The Operational Cost could be figured out to a near exact value only when the facility is operational, lack of operational data on cost lead to assumptions.
- Depreciation of equipments was not accounted for both for RRA and Total Purchase.
- Cost of consumables as caps, gloves etc were not accounted for.

Appendix – 1

List of investigations, Specialty – their percentage and price:

S.No	Investigation	Speciality	Percentage	Price
1	Potassium (Serum)	Biochemistry	**34%**	120
2	Sodium (Serum)			120
3	Renal Function Test (RFT)			600
4	Blood Glucose Fasting			80
5	Blood Glucose 2 Hours PP			80
6	Urine Routine			230
7	Albumin			110
8	Urine Culture			320
9	Liver Function Test (LFT)			825
10	Cardiac BioMarkers			850
11	Stool Routine			200
12	Stool Microscopic			250
13	Keratinin Serum			120
14	SGOT			140
15	SGPT			140
16	Lipid Profile			700
17	Uric acid Serum			150
18	Serum Electrolytes			350
19	Glycolated Haemoglobin			650
20	Magnesium (Serum)			450
21	Calcium (Serum)			150
22	Thyroid Profile			150
23	Creatine phosphokinase			850
24	Phosphorus (Serum)			140
25	Vitamin-D (25 OH)			1550
26	Thyroid Stimulating Hormone			350
27	Vitamin B12			900
28	Bilirubin Total			190
29	Urine protein creatinine ratio random			450
30	Lactate dehydrogenase			300
31	Serum Amylase			400
32	Iron, serum (Fe)			410
33	PTH (PARATHYROID HORMONE), INTACT			1,100
34	Alpha Fetoprotein			750
35	Total Protein			150
36	Alkaline Phosphatase			160
37	Urine Protein(24 hr)			320

38	Urine Osmolality			530
39	Albumin(Body Fluids)			100
40	Bicarbonate			140
41	Follicle-stimulating hormone			420
42	Leutinizing Hormone			420
43	Total Cholesterol			100
44	Lactate Dehydrogenase(LDH),Body Fluids			290
45	Triglycerides			190
46	Microalbumin			560
47	Lactic acid (lactate)			740
48	Estradiol			460
49	Globulin			250
50	Progesterone			420
51	LDL - Cholesterol			150
52	ANTITHYROGLOBULIN ANTIBODY; ANTI Tg			1,000
53	HDL - Cholesterol			150
54	Phosphorous(Urine)			180
55	Urine Urea			180
56	A/G RATIO			230
57	Urea/Creat Ratio			180
58	LH & TESTOSTERONE,TOTAL			980
59	VLDL - Cholesterol			210
60	Random Glucose(Fluids)			70
61	Transferrin			1,250
62	Complete Blood Count (CBC)	Hematology	**13%**	300
63	Platelets			150
64	ABO - Rh Type			120
65	MCV			60
66	MCH			60
67	MCHC			60
68	WBC			90
69	Erythrocyte Sedimentation Rate			100
70	Neutrophil			70
71	Lymphocyte			70
72	Eosinophil			70
73	Monocyte			70
74	Basophil			70
75	Activated Partial Thromboplastin Time			500
76	CBC + DIFF			350
77	Reticulocytes			300
78	Fibrinogen			1,000
79	Sickling Test			210

80	Prothrombin Time & INR			420
81	Semen Analysis			560
82	Factor IX assay functional			1,650
83	Factor VII assay functional			2,750
84	Factor VIII assay functional			1,650
85	APTT Mixing Studies			900
86	Specific Gravity			130
87	Ketone Bodies			120
88	Aerobic C&S Blood	Microbiology	**36%**	900
89	Aerobic C&S Blood (Paediatric&Neonat)			900
90	Aerobic C&S Body Fluids			900
91	Aerobic C&S Broncho-alveolar Lavage			900
92	Aerobic C&S Conjunctival Swab			900
93	Aerobic C&S Nasal Swab			900
94	Malaria (Peripheral Smear)			600
95	Dengue			950
96	Typhoid			450
97	Sputum AFB			120
98	HBsAg			700
99	Aerobic C&S			900
100	Aerobic C&S Pus			900
101	Aerobic C&S Sputum			900
102	Aerobic C&S Stool			900
103	Aerobic C&S Throat Swab / Washings			900
104	Aerobic C&S Tips Catheter,Suction,Tracheal			900
105	Aerobic C&S Urethral Swab			900
106	Aerobic C&S Urine			900
107	Aerobic C&S High Vaginal Swab/Cervical			900
108	Aerobic C/S Semen			1,000
109	AFB Culture Body Fluids			1,000
110	AFB Culture BAL			1,000
111	AFB Culture CSF			1,000
112	AFB Culture			1,000
113	AFB Culture Pus			1,000
114	AFB Culture Sputum			1,000
115	AFB Culture Stool			1,000
116	AFB Culture Urine			1,000
117	AFB Culture High Vaginal Swab/Cervical			1,000
118	AFB Stain (Z N) / Smear Exam			250
119	AFB Stain (Z N) / Smear Exam.-			250

	Sputum			
120	AFB Stain (Z N) / Smear Exam.-Urine			250
121	AFB Stain (Z N) / Smear Exam.-BAL			250
122	AFB Stain (Z N) / Smear Exam.-CSF			250
123	AFB Stain (Z N) / Smear Exam.-Pus			250
124	Anaerobic C&S Blood			1,400
125	Anaerobic C&S Body Fluids			1,400
126	Anaerobic C&S Broncho-alveolar Lavage			1,400
127	Anaerobic C&S CSF			1,400
128	Anaerobic C&S			1,400
129	Anaerobic C&S Pus			1,400
130	Anaerobic C&S Stool			1,400
131	Anaerobic C&S High Vaginal Swab/Cervical			1,400
132	Fungal (Yeasts) Sensitivity Testing			1,450
133	Fungal C&S Blood			1,000
134	Fungal C&S Body Fluids			1,000
135	Fungal C&S Broncho-alveolar lavage			1,000
136	Fungal C&S Conjunctival Swab			1,000
137	Fungal C&S CSF			1,000
138	Fungal C&S			1,000
139	Fungal C&S Pus			1,000
140	Fungal C&S Sputum			1,000
141	Fungal C&S Stool			1,000
142	Fungal C&S Throat Swab			1,000
143	Fungal C&S Tips Catheter,Suction,Tracheal			1,000
144	Fungal C&S Urethral Swab			1,000
145	Fungal C&S Urine			1,000
146	Fungal C&S High Vaginal Swab/Cervical			1,000
147	KOH Mount - Body Fluid			250
148	Tuberculosis Screening (Mantoux test)			150
149	Chikungunya IgM			900
150	Dengue Virus IgG/IgM, NS1Ag			1,650
151	Malaria Antigen			600
152	HIV I & II			550
153	Anti HCV			850
154	Cell Block		**17%**	1,000
155	FNAC - For Reporting			1,500
156	Frozen Section/Intra Operative Cytology - one sample			1,800

157	Diagnostic Biopsy	Histopathology		1,400
158	Excision Biopsy			1,800
159	Large Specimen Biopsy			1,900
160	Radical Specimen Biopsy			3,000
161	Interventional FNAC			2,000
162	PAP Smear			600
163	Perisystemic Examination			2,700
164	Estrogen and Pregesterone Receptors			2,700
165	Immunoflurescence 2 Antibody			2,700
166	Immunoflurescence 4 Antibody			5,300
167	Immunoflurescence 6 Antibody			8,000
168	Immunoflurescence 8 Antibody			10,500
169	Bone Marrow Biopsy			1,100
170	Radical Prostatectomy			6,300
171	Frozen Section/Intra Operative Cytology Per Specimen 2 Specimen			2,500
172	Frozen Section/Intra Operative Cytology Per Specimen 3-5 Specimen			3,200
173	Frozen Section/Intra Operative Cytology Per Specimen 5 -10 Specimen			4,800
174	TRU CUT Biopsy-Urgent			2,500
175	Ultrasound/ CT Guided FNAC Report (Histopath)			1,600
179	Body Fluids for Malignant Cytology			800
180	Frozen Section/Intra Operative Cytology >10 Spec			10,000

Appendix – 2

Investigations w.r.t. specialty

***General Surgery*:**

S.No	Procedure	Investigations
1	Abcess drainage including breast and perianal	CBC, RFT, RBS, Urine Routine
2	Wound Debridement	CBC, RFT, RBS, Urine Routine
3	Appendicectomy	CBC, RFT, RBS, Urine Routine, Chest X – Ray, ECG (If Age > 45)
4	Fissurotomy or Fistulectomy	CBC, RFT, RBS, Urine Routine, Chest X – Ray, ECG (If Age > 45)
5	Hemorrohoidectomy	CBC, RFT, RBS, Urine Routine, Chest X – Ray, ECG (If Age > 45)
6	Circumcision	CBC, RFT, RBS, Urine Routine
7	Hydrocele Surgery	CBC, RFT, RBS, Urine Routine, Chest X – Ray, ECG (If Age > 45)
8	Herniorraphy	CBC, RFT, RBS, Urine Routine, Chest X – Ray, ECG (If Age > 45)
9	Suprapubic Cystostomy	CBC, RFT, RBS, Urine Routine
10	Diagnostic Laparoscopy	CBC, RFT, RBS, Urine Routine, Chest X – Ray, ECG (If Age > 45)
11	Cysts and Benign tumor of the plate	CBC, RFT, RBS, Urine Routine
12	Excision Submucous Cysts	CBC, RFT, RBS, Urine Routine

***General Medicine*:**

S.No	Procedure	Investigations
1	Pleural Aspiration	-------
2	Skin Scraping for fungus/ AFB	-------
3	Skin Biopsies	-------
4	Abdominal Tapping	Albumin
5	Fever Short duration (<1 Week)	CBC, Chest X Ray, Urine Culture
6	Fever Long Duration (>1 Week)	CBC, Chest X Ray, Malaria (Peripheral Smear), Dengue, Typhoid, Platelets, LFT, USG abdomen.
7	Typhoid	Typhoid
8	Malaria/ Falaria	Malaria
9	Pulmonary Tuberculosis	CBC, Chest X Ray, Malaria (Peripheral Smear), Dengue, Typhoid, Platelets, LFT, USG abdomen, Sputum AFB
10	Viral Hepatitis	CBC, Chest X Ray, Malaria (Peripheral Smear), Dengue, Typhoid, Platelets, LFT, USG abdomen HBsAs
11	Leptospirosis / Meningitis and Haemorrhagic fever	CBC, Chest X Ray, Malaria (Peripheral Smear), Dengue, Typhoid, Platelets, LFT, USG abdomen,
12	Malignancy	-------
13	Bronchial Asthma/ Pleuraleffusion/ Pneumonia/ Allergic Bronchitis/ COPD	Chest X – Ray
14	Chest Pain (IHD)/ Giddiness (HT)	ECG, Cardiac Biomarkers

15	GI Bleed/ Portial hypertension/ Gall bladder disorder/ Dysentry/ Diarrhoreas	CT Scan Abdomen
16	Anemia/ Bleeding disorder/ Malignancy	Bone Marrow biopsy
17	Cholera/ Measels/ Mumps/ Chickenpox	-------

***Gynecology & Obstetrics*:**

S.No	Procedure	Investigations
1	Episiotomy	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
2	Forceps Delivery, VECC	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
3	Crniotomy- Dead foetus/ Hydrocephalus	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
4	Caeserean Section	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
5	Female Sterilization (Mini Laparotomy & Laparoscopic)	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
6	D&C	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
7	MTP	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
8	Bartholin Cyst Excision	-------
9	Suturing Perimeal Tears	-------
10	Assisted Breech Delivery	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy

11	Cervical Cautery	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
12	Normal Delivery	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
13	Midtrimester Abortion	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy
14	Asissted twin delivery	CBC, RFT, RBS, Urine Routine, USG abdomen for Pregnancy

***Pediatrics*:**

S.No	Procedure	Investigations
1	Minor Surgery	CBC, Chest X - Ray
2	I & D	CBC, Chest X – Ray
3	Perpuceal Dilatation	CBC, Chest X – Ray
4	Meatotomy	CBC, Chest X - Ray

***Ophthalmology*:**

S.No	Procedure	Investigations
1	Superficial Infections	-------
2	Deep Infections	-------
3	Refractive Error	Vision testing
4	Glaucoma	Intra Orbital Pressure
5	Eye problems following systemic disorder	-------

6	Cataract	-------
7	Foreign Body & Injuries	Accordingly CT Scan
8	Squint and Amblyopia/ Corneal Blindness/ Oculoplasty	Vision test

***Preventive Health Checkup*:**

S.No	Investigations - Male	Investigations – Female
1	Complete Blood Count	Complete Blood Count
2	USG – Abdomen	USG – Abdomen
3	X Ray PA View	Blood glucose Fasting
4	Chest X - Ray	Blood glucose PP
5	Liver Function Test	Keratinin Serum
6	Complete Haemogram	Uric acid
7	Blood Glucose PP	Stool routine
8	Blood Glucose Fasting	Stool Microscopic
9	Keratinin Serum	ECG
10	Uric acid Serum	ABO – Rh Type
11	Stool Routine	Perisystemic examination
12	Stool Microscopic	SGOT
13	ECG	SGPT
14	Urea	Urine Routine
15	ABO – Rh Type	Chest X – Ray
16	Lipid Profile	Urea

17	OPD Consultation	OPD Consultation

***Orthopedics*:**

S.No	Procedure	Investigations
1	Osteomyelitis	CBC, BGF, Uric acid, bone marrow biopsy
2	Rickets /Nutritional Deficiencies	CBC, BGF, Uric acid
3	Poliomyelitis with residual Deformities/JRA/RA	CBC, BGF, Urea
4	RTA/Polytrauma	CBC, BGF, Urea
5	Synovial or bone biopsy from HIP	CBC, BGF, Uric acid, Bone marrow biopsy
6	Girdle stone Arthoplasty	CBC, BGF, Uric acid, bone marrow biopsy
7	External Fixation Appleication Pelvis femur, tibia humerus forearm	CBC, BGF, Uric acid
8	Drainage of fracture	CBC, BGF, Uric acid
9	Hand, Foot bone and cervicle	CBC, BGF, Uric acid
10	Dislocation elbow, shoulder, Hip, Knee	CBC, BGF, Uric acid, Urea
11	Wrist dislocation on intercarpal joints	CBC, BGF, Urea
12	High Tibial Osteotomy	CBC, BGF, Urea
13	Debridement of hand/foot	CBC, BGF, Uric Acid
14	Patellectomy	CBC, BGF, Uric Acid, Bone marrow biopsy

15	Repair of ligaments of knee	CBC, BGF, Urea, Urine culture

***Pediatrics*:**

S.NO	Procedure	Investigations
1	ARI/ Bronchitis Asthmatic	Throat Swab, Sputum, CBC, Diff
2	Diarrohoeal Diseases	Stool Culture, CBC
3	Protein Energy Malnutrition and Vitamin Deficiencies	CBC, Blood Serum, Amylase,
4	Pyrexia of unknown origin	CBC + Diff, Serum
5	Bleeding Disorders	CBC + Diff
6	Diseases of Bones and Joints	CBC
7	Childhood Malignancies	
8	Liver Disorders	LFT, Stool Routine, Stool Microscopic
9	Paediatric Surgical Emergencies	
10	Poisoning, Sting, Bites	CBC, Stool Routine,Protien

***Neonatology*:**

S.NO	Procedure	Investigations
1	Hypoglycemia	BGF, BG PP, CBC
2	Neonatal Sepsis	
3	Neonatal Jaundice	CBC, Stool Microscopic, LFT, Urea

4	Congenital malformations	
5	Neonatal diarrhea	CBC, Stool Routine
6	HIV/AIDS	ELISA
7	Hypocalcaemia	Ca, CBC, RFT
8	Blood disorders	CBC + Diff, Serum, proteins
9	UTIs	Urine culture

***Chest Diseases*:**

S.NO	**Procedure**	**Investigations**
1	Fever	CBC, Urine
2	Cough with Expectoration / Blood Stained	Sputum, CBC, Throat Swab
3	Hemoptysis	CBC
4	Chest Pain	
5	Wheezing	
6	Breathlessness	

***Nephrology*:**

S.NO	**Procedure**	**Investigations**
1	Uncomplicated UTI	RFT, Urine analysis, CBC + Diff
2	Nephrotic Syndrome - Children/ Acute Nephritis	RFT, Urine analysis, CBC
3	Nephrotic Syndrome – Adults	RFT, Urine analysis, CBC
4	HT, DM	RFT, Urine analysis, CBC

5	Asymptomatic Urinary Abnormalities	RFT, Urine analysis, CBC
6	Nephrolithiasis	RFT, Urine analysis, CBC
7	Acute renal Failure/ Chronic Renal Failure	RFT, Urine analysis, CBC
8	Tumors	RFT, Urine analysis, CBC

***ENT*:**

S.NO	**Procedure**	**Investigations**
1	ASOM/SOM/CSOM	
2	Otitis External / Wax Ears	
3	Polyps – Ear	
4	Mastoiditis	
5	Tonsillitis/Pharyngitis/Laryngitis	
6	Quinsy	
7	Malignancy Larynx	
8	Epistaxis	
9	Polyps - Nose	
10	Sinusitis	
11	Septal Deviation	

***Urology*:**

S.NO	Procedure	Investigations
1	Hydronephrosis	RFT, Creatinin, CBC
2	Urinary Tract Injuries	RFT, Creatinin, CBC, Puss
3	Cystic Kidney	Puss, RFT, Creatinin
4	Undesended Testis	
5	Mega Ureter	
6	Extrophy	
7	Stricture Urethra	
8	Stone Diseases	RFT, CBC
9	GUTB	
10	Trauma Urinary Tract	

***Dental Surgery*:**

S.NO	Procedure	Investigations
1	Dental Caries/Dental Abcess/Gingivitis	CBC
2	Periodontitis	CBC
3	Minor Surgeries, Impaction, Flap	CBC
4	Malocclusion	CBC
5	Prosthodontia (Prosthetic Treatment)	CBC
6	Maxillo Facial Surgeries	CBC
7	Neoplasms	CBC

Appendix – 3

Scope of Investigations of Equipments

Department	***Equipment***	***Investigations***
Biochemistry	ABG Machine	pH
		Carbondioxide
		Oxygen
		Potassium
		Sodium
		Calcium
		Chloride
		Glucose
		Lactate
		Creatinin
		Bilirubin
		Haemoglobin
		Iron
		Blood - Haemoglobin
		Renal Function Test (RFT)
		Blood Glucose Fasting
		Blood Glucose 2 Hours PP
		Urine Routine
		Albumin
		Urine Culture
		Liver Function Test (LFT)
		Cardiac BioMarkers
		Stool Routine
		Stool Microscopic
	Bio Chemistry Analyzer	Keratinin Serum
		SGOT
		SGPT
		Lipid Profile
		Uric acid Serum
		Serum Electrolytes
		Glycolated Haemoglobin
		Magnesium (Serum)
		Calcium (Serum)
		Thyroid Profile
		Creatine phosphokinase
		Phosphorus (Serum)
		Vitamin-D (25 OH)

		Thyroid Stimulating Hormone
		Vitamin B12
		Bilirubin Total
		Urine protein creatinine ratio random
		Lactate dehydrogenase
		Serum Amylase
		Iron, serum (Fe)
		PTH (PARATHYROID HORMONE), INTACT
		Alpha Fetoprotein
		Total Protein
		Alkaline Phosphatase
		Urine Protein(24 hr)
		Urine Osmolality
		Albumin(Body Fluids)
		Bicarbonate
		Follicle-stimulating hormone
		Leutinizing Hormone
		Total Cholesterol
		Lactate Dehydrogenase(LDH),Body Fluids
		Triglycerides
		Microalbumin
		Lactic acid (lactate)
		Estradiol
		Globulin
		Progesterone
		LDL - Cholesterol
		ANTITHYROGLOBULIN ANTIBODY; ANTI Tg
		HDL - Cholesterol
		Phosphorous(Urine)
		Urine Urea
		A/G RATIO
	Electrolyte Analyzer	Sodium Serum
		Potassium Serum
		Chloride Serum
		Triglycerides
		Microalbumin
		Lactic acid (lactate)
		Estradiol
		Globulin
		Progesterone
		LDL - Cholesterol
		ANTITHYROGLOBULIN ANTIBODY; ANTI Tg
		HDL - Cholesterol

		Phosphorous(Urine)
		Urine Urea
		A/G RATIO
		Urea/Creat Ratio
		LH & TESTOSTERONE,TOTAL
		VLDL - Cholesterol
		Random Glucose(Fluids)
		Transferrin
Haematology	Haematology analyzer	WBC
		NE%
		LY%
		MO%
		EO%
		BA%
		NE#
		LY#
		MO#
		EO#
		BA#
		RBC
		HGB
		HCT
		MCV
		MCH
		MCHC
		RDW- CV
		RDW- SD
		PLT
		PCT
		PDW
		MPV
		Erythrocyte Sedimentation Rate
		Neutrophil
		Lymphocyte
		Eosinophil
		Monocyte
		Basophil
		Activated Partial Thromboplastin Time
		CBC + DIFF
		Reticulocytes
		Fibrinogen
		Sickling Test
		Prothrombin Time & INR
		Semen Analysis
	Coagulation Analyzer	AT III

		PT
		Quantitative FIB
		TT
		a2AP
		Factor IX assay functional
		Factor VII assay functional
		Factor VIII assay functional
		Heparin
		Protiens C & S
		Lupus anticoagulant
		Plasminogen
		APCR - V

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