BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES
COURSE HANDOUT

Part A: Content Design

Course Title	Software Project Management
Course No(s)	SE ZG622 / SS ZG622
Credit Units	4
Course Author	K G Krishna / Vishwanathan Hariharan / Subbu S / Anita Ramachandran
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Date	

Course Description

Overview of Software Engineering, Project Management Concepts, Software Process & Project Metrics, Software Project Planning, Project Evaluation, Selection of an appropriate project approach, Software site, effort and cost Estimation, Risk Analysis & Management, Project Scheduling & Tracking, Activity Planning, Resource Allocation, Project Monitoring & Control, Managing Contracts, Managing People and Organizing teams, Software Quality Assurance, Software Configuration Management and cross-cultural issues in project management

At the end of the course, the student shall be able to answer the following typical questions:

- What are the challenges faced by the project manager in managing people, processes, and stakeholders during a software project?
- What are software metrics and how can they be used to manage a software project and the software process?
- How does a Project Manager generate reliable estimates of efforts, cost, and project duration?
- What techniques can be used to formally asses the risks that can have an impact on project success?
- How does a software project manager select the right software process model for the development of software?
- How is a project scheduled with sequencing of activities and allocation of resources?
- What is software quality assurance and its activities in project management?
- How is change managed during the development of computer software and after delivery to the customer?
- …

Course Objectives

No	Objective
CO1	Introduce software project management as a **structured methodology** for professional software development
CO2	Expose students to the **operational challenges** involved in managing large software projects through experiential learning
CO3	Enhancing the knowledge and skills of engineers in **proactively anticipating problems** and resolve them effectively by sharing lessons-learnt and best-practices

Text Books

T1	Bob Hughes, MikeCotterell and Rajib Mall, *Software Project Management*, 5th Edition, TMH, 2011
T2	Roger S Pressman, *Software Engineering : A Practitioner's Approach*, 7th Edition, TMH, 2010 (or latest)

Reference Books & other Resources

R1	Ian Sommerville, *Software Engineering*; 8th Edition, Addison Wesley, 2009 (or latest)
R2	Pankaj Jalote, *Software Project Management in Practice*, Pearson Education, 2002

Module Structure

No	Title of the Module	C/O*	Ref.#
M1	Introduction to Software Project Management	C	T1,T2
M2	Overview of Software Development Models	C	T2
M3	Project Initiation & Defining Project Goals	C	T1
M4	Software Effort Estimation	C	T1
M5	Software Project Planning	C	T1
M6	Software Quality Planning	C	T2
M7	Risk Management	C	T1,T2
M8	Change Management	C	T2,T1
M9	Project Monitoring & Control	C	T1
M10	Team & Stakeholder Management	C	T1
M11	Project Closure & Warranty Maintenance	C	IM/ORG
M12	Quality Management Systems	C	T2,T1
M13	Contract Management	C	T1
M14	Project Evaluation	C	T1

M15	Proposal Making	O	IM/ORG
M16	Cross-cultural issues in Software Project Management	O	IM
M17	Tools for Software Project Management	O	IM/ORG
M18	Software Maintenance	O	IM/ORG
M19	Product Life-cycle Management	O	IM/ORG
M20	Remote Infrastructure Management	O	CS/IM

*Core Topics—to be covered for all / **Optional Topics**—specific to Organization/Student Profile under the discretion of the instructor

#T1,T2 (Text Books); **IM**: Instructor-provided Material; **ORG**: Material/documents sourced from students' organization

While effort is made to ensure the topics covered in this course are in alignment with referenced text-books, due to changing technologies and emerging practices in this field, it is strongly advised that students refer to their own sources on the net or their own organizations for comprehensive understanding of the concepts.

Learning Outcomes:

No	Learning Outcomes
LO1	Students to be able to transition from their current role as programmers / developers to managers of projects and teams (**career migration**)
LO2	On-the-job demonstration of skills pertaining to **usage of techniques/tools** for professional software development
LO3	**Ability to plan** activities or **anticipate issues** proactively and **communicate** the same effectively to organization's stakeholders

Course Overview & Terminology

This basic level course on 'Software Project Management (SPM)' under Work Integrated Learning Programme (WILP) of BITS-Pilani is targeted for working professionals in the IT industry who during their career seek **enhancement of their role from engineer/programmer to project manager**.

Scope:
While project management, in general, cover the whole spectrum of activities starting with the customer evaluating the project, deciding to contract, preparation of tender/RFP documents to contract execution by vendor to post-contract services, the primary of focus of this course is confined to **vendor's role in contract execution** phase, i.e., all project management activities that trigger upon receipt of formal signed contract document from the customer—from Requirements Engineering phase to Acceptance Phase. However, the topics pertaining to pre-contract and post-contract phases are highlighted as well for overall understanding of project life-cycle.

Perspective (Customer vs. Vendor): Typical profile of students taking this course may include working professionals from Indian IT services companies, Multi-national captive R&D centres, or from non-IT organizations in Government, Space, and Defence sectors—and projects may encompass development of custom software or product engineering services. However, catering to wider students' interest and without loss of generality, the recorded modules of this course adopt a narrative from the **perspective of a typical offshore IT services provider in India in custom development of software for an overseas customer.**

	Pre- Contract	Contract	Post- Contract

|	**Pre-Contract**	**Contract Execution**	**Post-Contract**
Customer	▪ Issue Request for Information or Proposal (RFI/RFP) ▪ Evaluate Vendor Proposals ▪ Contract Management	▪ Project Reviews ▪ Request Changes ▪ Acceptance Testing	▪ Warranty Mgmt. ▪ Project Extn. to Maintenance services
Vendor	▪ Project Evaluation ▪ Respond to RFP (Proposal Making) ▪ Negotiating for win	▪ Project (effort) estimation ▪ Project Planning ▪ Project Execution / Monitoring	▪ Providing warranty ▪ Undertaking product sustenance services

The roles of Project Manager (PM) and Business Development Manager (BDM) are considered the most unambiguous with clear responsibility for end-to-end delivery and Business/Revenue

Project Management
(Scope of the Course)
Modules: M1 ➜ M14

SPM is more of an art than science—while technical methods can be learnt from books, case discussions accelerate learning of its undocumented 'soft' side

Terminology:

As with technology, the vocabulary of project management undergoes metamorphosis in alignment with new models, ideas and practices. Notwithstanding the cultural differences among nations (organizations), are different words in use representing the same concept, function or management roles. In order for the student to remain focused on the hard technical aspects of project management without getting side-tracked by subtle differences in the vocabulary, the below table identifies few such often-used terms with their semantic equivalents.
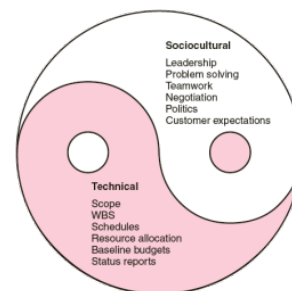
Commonly used Term (Organization-neutral vocabulary)	Related Terms / Synonyms (used without major loss of meaning, Org-specific terms) / Working Definition
Master Contract	Master Business Agreement (MBA), Memorandum of Understanding (MoU)
Contract	Statement of Work (SoW),
Invitation To Tender (ITT), Bid Docs.	Request for Proposal (RFP), Request for Quotation (RFQ)
Vendor Prequalification	Request for Information (RFI), Due Diligence
Proposal	Tender, (Technical/Commercial Proposal Response from Vendor)
Project Manager	(Project Leader), Delivery Manager, …
Program Manager	ODC Manager, Account Manager,
Business Manager	Sales Manager, Relationship Manager,
Domain Expert	Someone with experience/knowledge of customer's business
Quality Management System (QMS)	Quality Assurance Model, Software Quality Assurance (SQA),…
Process	System, Method, Methodology,… (Agile, Waterfall,…)
Version Management	Configuration Management, Release Management, Build Management
Development Model	Software Engineering Model, Process Model
Business Model	Revenue Model, Payment Terms(Fixed-price, Time&Material,…)
Outsourcing	Customer outsources his non-core processes/services to vendors
Offshoring, Nearshoring	Location of vendor (far-away on a different country/time-zone, near)
Offshore Development Centre (ODC)	Vendor's premises (dedicated to serving customers' business)
Onsite (Development) Centre	Vendor's office/location (near the customer, typically for coordination)
Nearshore Development Centre	Vendor's development centre located (or co-located) near to customer
Development Model vs. Business Model	Waterfall, Agile, Prototyping vs. Fixed-Price, T&M,…
Project Manager vs. Program Manager	Project Manager (PM): Responsible for single project; Program Manager (PgM): Managing resources/delivery for multiple projects
Project Manager vs. Business Manager	Business Manager: Counterpart of PgM responsible for business development (sourcing of new customers/projects)
Architect vs. Designer	Architect: Develops framework/model, Designer: Detailed Engineering
ISO 9001 vs. CMMI	ISO 9000 (generic QMS certification) vs. CMMI (software development maturity assessment)
Quality Assurance vs. Quality Control	QA (more of prevention) vs. QC (controlling/checking after production)
Stakeholder vs. Shareholder	Shareholder's (outside the company) with 'distant interest' in profits vs. Stakeholders in the company who vouch for project/program success
Engineering vs. Programming	(Professional) Design/Development following a methodology vs. individual effort in coding/testing
Custom Software Development vs. Product Development	Bespoke software (tailored to the needs of the customer) vs. Off-the-shelf (ready-to-deploy software with minimal customization)
Software Engineering vs. Product Engineering	Development of software (typically bespoke, using structured methodology) vs. R&D, Maintenance and Enhancements (multiple products/releases over a common product platform, aka product-line architecture)

Prof K G Krishna
kgk@bits-pilani.ac.in

Detailed Structure

Introductory Video/Document: *<< Introducing the faculty, overview of the course, structure and organization of topics, guidance for navigating the content, and expectations from students>>*

- Each of the sub-modules of **Recorded Lectures** (RLx.y) shall delivered via **30 – 60mins videos** followed by:

- **Contact session** (CSx.y) of 2Hr each for Illustrating the concepts discussed in the videos with exercises, tutorials and discussion on case-problems (wherever appropriate); contact sessions (CS) may cover more than one recorded-lecture (RL) videos.

Course Contents

Type	Title	Description
M1: Introduction to Software Project Management—Concepts, Definitions		
RL1.1	Introduction to Software Project Management—Concepts, Definitions	**RL1.1 Introduction to Software Project Management** This introductory module gives an overview of Software Project Management by explaining various concepts and terms being used in the industry. It highlights the challenges involved in managing software projects and the role played by project and program managers. • Project - a technical definition • How software projects are different • Software Project Life-Cycle • Phases of Software Development • Project vs. Program • Role of a Project Manager • Project Stakeholders • Measuring Success of a Project
CS1.1		Demystify the vocabulary in Software Engineering and Project Management with examples; Illustrate how a set of activities is different from a project; highlight uniqueness of a project and the challenges faced by software project managers; differentiate between process, project and program with examples from each.
M2: Overview of Software Development Models		
RL2.1	Overview of Software Development Models	**RL2.1 Overview of Software Development Models** For those who are not familiar with principles of software engineering (recommended pre-requisite for this course), this module introduces the concept of a 'Process' and formal 'Methodology' and describes various software engineering process models adopted for the development of software systems. • Description of a 'Software Process' • Plan-driven vs. Agile Process Models • Requirements Engineering Process • Design Process • Evolutionary Development
RL2.2	Choosing the right development model	**RL2.2 Choosing the right development model** Based on constraints and challenges involved in the project, adopting the right process model is the key to success of any project. This module recommends the right process model based on requirements stability, complexity and schedule constraints.
RL2.3	Choosing the right development model—a caselet	**RL2.2 Choosing the right development model—a caselet** This caselet illustrates a scenario in which a customer demands adoption of Agile methods in an organization accustomed to traditional plan-driven models. It highlights the agile method as followed by the organization along with recommendations for successful adoption of agile methodology • Implementation of Agile Methods • Recommendations for project success
CS2.0		CS 2.0: Discuss the rationale for the choice of a particular model by analysing the demands of a customer; how agile methodology is more appropriate for today's customers with time-to-market constraints; how to

		ensure off-shore developers (vendors) do not lose money by choosing the right choice business model (Time-and-Materials or T&M as advocated in this caselet).
M3: Project Initiation & Defining Project Goals		
RL3.1	Identifying Project Objectives & Sub-goals	**RL3.1 Project Initiation & Identifying Objectives (Goals)** In this course, we assume a software development project comes to life soon after a business contract is signed with the customer by the vendor organization wherein the contract clearly specifies the scope of work, terms and conditions governing the engagement. However, the pre-contract phases of project evaluation, proposal-making and negotiating for award of contract with the customer are covered separately in another module at the end of this course as these activities are usually led by Business Managers. The commencement of a project is usually celebrated with a 'kick-off' meeting/party organized by the Project Manager with project team members and other stakeholders in the organization. Setting the Objective (Goal) in the language of business is the first step in the project definition stage. This module illustrates how the project goal should be linked to the overall business strategy of a customer; defines project objectives, sub-objectives…; and managing for success. • Setting Goal/Sub-Goals • Project Monitoring using Measures/Metrics • Criteria for project success
RL3.2	Defining Metrics and Establishing a Metrics Baseline	**RL3.2 Software Metrics & Baselining** This module gives an overview of 'Metrics' in the context of software development; differentiates process vs project metrics; how to define project metrics and establish a metrics baseline for organizational process improvement • Defining SMART metrics • Product vs. Process vs Project metrics • Metrics Baselining
CS3.0		CS3.0: Discuss with examples how project objectives are different from project metrics; what constitutes a good metric (SMART metric); how process metrics are derived from project metrics; importance of metrics baselining for continuous improvement.
M4: Software Effort Estimation		
RL4.1	Introduction Software Estimation	**RL4.1 Introduction to Software Estimation** Everything in a project starts with 'estimates'—there's nothing like a 'right' estimate, and estimates will only be 'correct' at the end of the project. However, the success of any software project is greatly dependent on arriving with 'realistic estimates' by adopting proven models along with the collective experience and insights of the team and the organization. This module illustrates the challenges of estimation and explains why estimations go wrong. • Purpose of estimation • Importance of accurate estimations
RL4.2	Software Estimation Techniques	**RL4.2 Software Estimation Techniques** This module walks-through various approaches to estimation—top-down and bottom-up—along with various factors affecting estimation • Top-down estimation

		- Bottom-up estimation - Work-Breakdown-Structure (WBS) - Converting software size into effort - Estimation Review by peers, experts and using alternate methods
RL4.3	Estimation by Function Point (FP) Method	**RL4.3 Estimation by Function Point (FP) Method** Function Point (FP) is one of the widely adopted methods for estimation of software size when the choice of technology or development platform/language is unclear. This module illustrates application of this method using an example software project.
RL4.4	Estimation by Object based Method	**RL4.4 Estimation by Object based Method** This module illustrates estimation of size by identifying objects and analysing their complexity (object points).
RL4.5	Estimation of Effort for all Phases	**RL4.5 Estimation of Effort for all Phases** Effort estimation commences after arriving at size estimate for the project. This module illustrates computation of effort (in person-months/weeks) for each phase of software development
CS 4.0		CS4.0: Discuss (with examples and practical insights) why software estimations are challenging in the context of changing customer requirements, technology uncertainty and shrinking development schedules; how to select the right model/approach for a given project; importance of estimation review meetings and the deciding criteria for 'fixing' the final estimate
M5: Software Project Planning		
RL5.1	Software Project Planning	**RL5.1 Software Project Planning** This module highlights the tasks involved in software project planning or contents of a typical software project plan in an ISO 9000/CMMi compliant organizations. In fact, project planning can also start from proposal planning (pre-contract phase) where pricing issues also considered. - Planning process/activities - Contents of software project plan - Agile planning (flavour of the time)
RL5.2	Project Scheduling	**RL5.2 Project Scheduling** Project scheduling starts soon after WBS and project planning. In a nutshell, scheduling involves sequencing the activities (arrived after WBS) in time taking into account precedence relationships among them. This module explains the activities involved scheduling using GANTT chart (bar-chart) as one example of representing schedule. - Scheduling activities - Scheduling problems - Scheduling activities/resources using GANTT chart
RL5.3	Project Scheduling using Network Diagram (AoN)	**RL5.3 Project Scheduling using AoN Diagramming** This modules illustrates the use of network diagrams (with an example of Activity-on-Node diagram) for representing activity dependencies and discovering 'critical path' in the project - Drawing AoN diagrams - Concept of 'Float' - Identification of 'Critical Path' (CP) - Schedule management by CP analysis

RL5.4	Project Resource Scheduling	**RL5.4 Project Resource Scheduling** After all the activities in a project are scheduled in time, resources (people, in software projects) are to be allocated to the activities considering their skill profiles and availability. This module explains the need for categorization of resources, the role of project/program managers in their optimum utilization, resource (load) balancing, and scheduling of resources and their associated costs. ■ Identification of Resource types ■ Resource Scheduling (Histogram) ■ Load Balancing (Resource Levelling) ■ Resource Optimization ■ Cost Profiling
CS5.0		CS5.0: Discuss (with examples from organization) contents of a typical software project plan by clearing identifying activity plan, resource plan, quality plan, risk management plan, change-management plan, communication plan, etc. Taking an example (organizing an event like birth day or marriage) make students sketch an AoN diagram, resource histogram, list items in quality/risk management plan (to be discussed in the next modules); make them identify dependencies among activities and the critical path, etc. Referring to a typical software project, illustrate how few key resources such as architects and designers are shared among several projects and how their effort to be planned as per their availability. Also to be discussed is the role of program manager (aka Delivery Head/ODC Manager) in channelling of resources across projects to ensure no 'bench'.
M6: Risk Management		
RL6.1	Risk Management	**RL 6.1 Risk Management** Risk is integral to any project, more so for software projects in particular due to large number of uncertainties (of people, technology, requirements, etc.) involved. This module highlights activities of risk analysis, risk planning and risk monitoring. Risk Management plan is included as part of project plan document. ■ Definition of 'Risk' ■ Risk Analysis / Prioritization / Impact Analysis ■ Risk Planning ■ Risk Monitoring.
RL6.2		**RL6.2 Risk Planning in a Project – a case example** This module identifies best practices in risk mitigation by their application in a real-life project
CS6.0		CS6.0: Discuss how risk planning is different from activity planning and the role of senior project managers or organization's risk check-lists in identification of risk elements in project activities; let students identify typical risks in their projects, analyse their likely impact should they occur and think about ways of mitigating if not avoiding such risks in future.
M7: Quality Planning		
RL7.1	Quality Planning	**RL7.1 Software Quality Planning** Planning of Software Quality Assurance (SQA) activities (such as reviews, inspections, testing and process audits) are done in parallel to the development activities planning like specifications, design and coding

		and Quality plan is part of the overall software project plan. This module describes typical QA activities in a project, QA organization structure, scheduling and monitoring of quality activities.
		▪ QA Team as part of the project ▪ Quality Planning ▪ Establishing Standards, Benchmarks and Metrics ▪ Quality Process audits ▪ Role of project quality manager in signing-off deliverables
CS7.0		CS7.0: Ask students to browse through their organization's QMS and present the template for Project/Quality planning; discuss the contents of the plan and their relevance to various projects; highlight metrics used for project reporting and quality related metrics; discuss how the project manager addresses the customer complaints received during the project.
M8: Change Management		
RL8.1	Change Management	**RL8.1 Change Management** Changes are inevitable in any software project and they can occur at any phase of software development. When not properly managed, changes not only impact schedule, cost, and quality, may also lead to architecturally fragile systems. This module explains how change-requests (CR) from customer are to be managed to the satisfaction of all stakeholders. Change Management plan is to be explicitly articulated in the project plan for large software projects adopting non-agile methods. ▪ Types of Change Requests ▪ Change Control Process ▪ Negotiating with Customers/Stakeholders
RL8.2	Managing Uncontrolled Change-Requests	**RL8.2 Managing Uncontrolled Change-Requests** This module illustrates the case of uncontrolled changes from a customer and how they are addressed in a real project
RL8.3	Managing Changes in Requirements and Schedule – A Caselet	**RL8.3 Change Management – A Case scenario** This case describes a hypothetical project with dynamic characteristics, and examines how variations in schedule and requirements can be handled ▪ Discusses in brief risk analysis and identification of process model for a project of the given nature ▪ Analyses some scenarios that can arise during the course of the project execution: 　o New marketing requirements 　o Shortened schedule 　o Project transition ▪ Examines factors that can be considered in each scenario to accommodate them into the project with minimal impact on schedule and quality
CS8.0		CS8.0: Discuss how change-requests are handled as per the organization's QMS; how to minimize the impact of scope-creep by the right choice of software development models (such as Agile methods); how maintaining change (issue resolution) logs help push back to the customer about changes that impact project schedules significantly; and finally strategies/techniques to be adopted for successfully negotiating with customer for recovering incremental costs involved in changes.

M9: Project Monitoring & Control		
RL9.1	Project Monitoring & Control	**RL9.1 Project Monitoring & Control** Tracking the progress of the project against plan and taking appropriate corrective action in case of bottle-necks/issues constitutes the daily core of a typical Project Manager once the projects gets into execution phase. This module explains various tools for schedule and cost monitoring of a project. • Tracking Project Schedule and Costs • Monitoring using Earned Value Analysis (EVA) • Project Monitoring & Control Cycle • Project Status Reporting
CS 9.0		CS 9.0: Discuss typical format of a project status report; how the level of detail or frequency of a project status report varies depending on the target stakeholder; using an example, illustrate application of EVA for realistic assessment of project progress against plan/budget; applicability of EVA for large development projects; controlling large scope-creeps by balancing scope, quality and schedule.
M10: Managing Project Teams & Stakeholders		
RL10.1	Managing Project Teams	**RL10.1 Managing Project Teams & Stakeholders** This is the 'soft' aspect of project management vis-à-vis the 'hard' or technical aspects discussed earlier. More than for resourcing a project, Human Resources (people) are considered as key asset in any software industry. Hence, HR managers and Project/Program Managers spend a lot of time in hiring qualified teams and motivating them for high performance. Moreover, resources are marshalled on demand from several functional divisions within the organization for the duration of the project and at the end of which they are transferred back to their parent divisions. This module explains the challenges faced by the project manager in ensuring team work and motivation, and also how the leadership skills of project manager is put to test when at times he/she needs to circumvent organizational politics in negotiating with stakeholders to get the needed resources on time. • Resource Mobilization in Software Projects • Maslow's 'Hierarchy of Needs' model for motivation • Negotiating with Stakeholders for Resources • Customer Complaint Resolution • Managing Distributed Teams • Reducing Work-related Stress and Burn-out
RL10.2	Managing Attrition and Stakeholders	**RL10.2 Managing Attrition and Stakeholders** As resources (people) in software project are highly 'mobile' and when a key member of the team leaves during the critical phase of project, the PM has to ensure the project does not get held up by planning the risk of attrition. This module highlights how people related challenges are to be addressed by the PM by demonstrating leadership in communication and negotiating with the stakeholders • Managing attrition in key resources • Stakeholder Management
RL10.3	Managing Distributed Teams – a Caselet	**RL10.3 Managing Distributed Teams** Large projects often involve project teams distributed across geographic locations in different time zones with varied cultures. Managing such projects pose its own challenges in communication and coordination.

		This module illustrates (via a caselet) the issues encountered in managing one such project. ▪ Need for virtual collaboration tools ▪ Overcoming communication barriers ▪ Addressing security and IP issues
CS10.0		CS10.0: Ask students to list their perception of team, colleagues and managers, and how the environment around them affect their on-the-job performance; the role played by their HR and Training division in their own skill enhancement; let students air their opinions on what really motivates them and why do they leave if they intend to; how customer pressures and escalations affect their morale and the role played by their managers in ensuring their work enjoyable and challenging; how managers leverage scarce resources in the company; concept of on-demand resourcing; addressing of customer complaints and managing at times 'unreasonable' expectations; managing remote teams across geographies; ensuring work-life balance;…
M11: Project Closure & Warranty Maintenance		
RL11.1	Project Closure & Warranty Maintenance	**RL10.1 Project Closure & Warranty Maintenance** For most development projects, formal sign-off by the customer upon acceptance testing at customer's site signals closure of the project when the customer is invoiced for the final payment. In fact, for many projects the period around the delivery deadline (pre- and post-delivery) is the most stressful for project teams as several issues related to shorting of specifications or bugs discovered during acceptance testing coupled with internal demands from finance/HR to release resources make up the testing time for project managers. This module explains the phases of Acceptance and Warranty by highlighting the issues faced during this critical period. ▪ Acceptance of Deliverables ▪ Post-delivery warranty Maintenance ▪ Post-warranty Maintenance/Upgradation
CS11.0		CS11.0: Discuss the steps involved in project closure and specifically the criteria used for moving into acceptance phase; highlight typical issues raised by the customer upon project delivery; handling of customer escalations related to defects discovered by the customer/end-users during acceptance testing, etc.; planning for (free) warranty maintenance; and transitioning to maintenance phase upon successful delivery.
M12: Quality Management Systems		
RL12.1	Quality Management Systems	**RL12.1 Quality Management Systems** Most of the large Indian IT offshoring service providers have well-documented processes as a result of either one of ISO 9000 certification or assessed under CMMI model. This module discusses how adoption of formal process models/standards help achieve maturity in project management processes in meeting demanding customer expectations. ▪ Overview of ISO 9000 & CMMI Models ▪ Six Sigma Methodology for Process Improvement ▪ Continuous Improvement ▪ Customer-specific Product Development Standards
CS12.0		CS12.0: Process vs Product quality; difference between ISO and CMMI

		models; process improvement by defect reduction using six sigma methodology using DMAIC framework; analysis of metrics for continuous improvements;…
M13: Contract Management		
RL13.1	Contract Management	**RL13.1 Contract Management** From the perspective of a customer who is awarding a contract to a vendor, it is the responsibility of customer's (project) manager to ensure the vendor conforms to and delivers as the contractual terms. This module explains different types of contracts and business models employed in various software outsourcing contracts. ▪ Contents of Software Contract Document ▪ Types of Contracts (Business Models) ▪ Due Diligence by Customer ▪ Contract Review
CS13.0		CS13.0: Show sample contract document/template used by the organization; types of contracts (fixed-price, time-and-material,…); discuss the criteria for selection of right business model (T&M vs. Fixed-Price in terms of risk to the vendor); customers performing due-diligence (evaluation) of vendors; contents of a typical RFI (Request for Information)/RFP (Request for Proposal); contract review and the process of contract renewal, etc.
M14: Project Evaluation		
RL14.1	Project Evaluation	**RL14.1 Project Evaluation** Undertaken by the customer before taking a decision to outsource or contract a project to an offshore vendor, project evaluation implies assessing the benefits of the project in terms of its contribution to profits, enhancing capabilities or other short- or long-term strategic goals. This models walks through various cost-benefit analysis models for assessing financial availability of the project as well as managing projects as portfolio to minimize overall impact of risk due to few projects. ▪ Cost-Benefit Analysis (Making a Business-case) ▪ ROI, Discounted Cash-flow method ▪ Project Portfolio (Program) management ▪ Non-financial considerations
CS14.0		CS14.0: More relevant for customers who plan projects for outsourcing or contracting to a vendor, the techniques described here can also be applied by the vendor/developer to make a business-case for this project by asking oneself the question: "Is this RFP (project) worth responding in the first place?" Discuss how their managers/CEOs take decisions before committing to projects; importance of due-diligence before accepting a project; criteria for selection of a particular project/customer; conducting feasibility study; analysing the project for intangible benefits; mitigating risks by choice of projects in a portfolio or program;…
M15: Proposal Making		
RL15.1	Proposal Making	RL15.1 Proposal Making Once the customer decides to contract a software project to an offshore (or onshore/nearshore/onsite) vendor, he typically floats an RFP (Request for Proposal, aka Tender) which contains brief description of the project along with terms and conditions. In response to RFP, the vendor prepares a proposal (answer to RFP) describing the proposed solution/approach,

		estimates/price, project organization structure, etc. This module illustrates the typical steps involved in proposal making—from the receipt of RFP to successfully negotiating for a win with the customer. ▪ Contents of a typical Proposal (Technical, Commercial) ▪ Project Methodology ▪ Effort/Cost Estimation ▪ Business Model (Payment Terms) ▪ Proposal Review ▪ Preparation for successful bid/win
CS15.0		CS15.0: Discuss the contents of a typical project proposal prepared by one of their organization's PMs (sans confidentiality issues); how estimates of effort/price are actually arrived at; typical demands of the customer; the role played by business managers in 'sealing' price in the proposal; various business models (T&M, fixed-price,…) recommended by the organization and experiences from such projects.
M16: Cross-cultural issues in Software Project Management		
RL16.1	Cross-cultural issues in Software Project Management	RL16.1 Cross-cultural issues in Software Project Management Project management is more of an art than science when it has to deal with real people and cultures. More than learning customer's language, understanding the socio-cultural aspects of the customer and being aware of our own (vendor's) cultural nuances vis-à-vis customer's play a significant role in successfully steering the project. This module highlights the cultural differences between western (including Indian) and oriental (Japan/Korea) customers by sharing the learnings from managing projects with a Japanese customer ▪ Cultural Differences between Western and Oriental Customers ▪ Minimizing Language barriers in Project Communications ▪ Requirements Change-management with Japanese customers ▪ Undocumented Ethics/Business Code-of-conduct
CS16.0		CS16.0: How to manage culture/language barriers while dealing with oriental customers (Japan, China, Korea,…); appreciation of cultural differences in quality and accounting for them in project planning; understanding of implicit code-of-conduct in business negotiations;…
M17: Tools for Software Project Management		
RL17.1	Technology/Tools for Project Management	**RL17.1 Tools for Software Project Management** While the common tools such as MS Excel/Project are more than adequate for managing small projects at a single location, managing large projects with several teams spread across the globe (virtual teams) in different time-zones necessitate use of enterprise project management (EPM) tools. Also available are the integrated tools for managing software processes from requirements capture to version management and delivery with real-time coordination and communication. This module highlights the benefits of such tools by examining few commercially available or open-source tools. ▪ Tools for Integrated Software Engineering and Management ▪ Version Management Tools ▪ Enterprise Project Management Tools (EPM) ▪ Use of real-time A/V communication tools (skype, webex, Telepresence systems,…)
CS17.0		CS17.0: Ask students to list various tools adopted in their own

		organizations; discuss the benefits and issues related to managing virtual teams; the role of release management tools (version control) in ensuring correctness and integrity of deliverable products.; …
M18: Software Maintenance		
RL18.1	Software Maintenance	RL18.1 Software Maintenance Software Maintenance services constitute major chunk of revenue stream for many Indian IT services companies under T&M model. By the pure technical definition of 'project', though managing maintenance services do not really fall under project management activity, this module identifies the processes adopted for maintaining large IT systems of the customer. ▪ Contents of a maintenance contract ▪ Maintenance life-cycle ▪ Metrics/SLA (Service Level Agreements) ▪ Processes/methodology for software maintenance ▪ Typical activities involved in maintenance ▪ Tools/Technologies adopted
CS18.0		CS18.0: Identify students who are working in non-development (maintenance) 'projects'; discuss their activities and processes adopted by the organization or customer; identify few metrics tracked and reported to customer; how activities like trouble-shooting, enhancing functionality or fixing defects etc., compare with developmental activities in terms of challenges and meeting SLAs;…
M19: Software Product Life-cycle Management (PLM)		
RL19.1	Software Product Life-cycle Management	**RL19.1 Software Product Life-cycle Management (PLM)** In product-centric organizations involved in all phases of a product life-cycle from concept R&D to development to marketing to maintenance/revisions to eventual phasing out the product-line, vendors assume ownership for sustenance of the entire life-cycle over long periods of existence of the product(s) in the market. This module explains the adoption of processes and PLM tools to support in the long evolution of customer's product range. Typically vendors enter into a long-term contract (program in a dedicated Offshore Development Centre) with customers wherein the vendor organization is seen as part of customer's global development / support infrastructure. ▪ PLM Processes/Tools ▪ Program/ODC organization ▪ Quality Assurance Processes ▪ ...
CS19.0		CS19.0: Many MNCs (automobiles, software, electronics) that have facilities in India are product-centric organizations cater to supporting their own product base targeted for their global customers; discuss typical activities, QA processes and standards adopted; how intellectual property rights are protected or shared among development partners;…
M20: Remote Infrastructure Management		
RL20.1	Remote Infrastructure Management	**RL20.1 Remote Infrastructure Management** Post 2000, the Indian Offshoring industry expanded from providing mere offshore development centres (ODCs) to augment customer's technical staff, to supporting customer's IT infrastructure (workstations, desktops, servers, networks, data centres, etc.) remotely by leveraging low-cost

		offshore infrastructure. Today, RIM services (along with other BPO services) occupy significant portion of Indian IT vendor's revenue stream. This module describes typical services rendered by Indian vendors, measures of performance and the skills required for managing such services. ▪ Infrastructure Maintenance ▪ ITIL standards/certifications ▪ IT Security/Performance Monitoring ▪ Metrics and governing SLAs
CS20.0		CS20.0: Ask students to list the criticality of meeting SLAs in RIM and typical performance data; discuss about how information security and privacy issues of customers are addressed; managing work-life balance while working in 24x7 shifts.

Part B: Course Handout

Academic Term	First Semester 2021-2022
Course Title	Software Project Management
Course No	SE ZG622 / SS ZG622
Lead Instructor	NARASIMHA BOLLOJU

Glossary of Terms
1. Contact Hour (CH) stands for a hour long live session with students conducted either in a physical classroom or enabled through technology. In this model of instruction, instructor led sessions will be for 22 CH.
   a. Pre CH = Self Learning done prior to a given contact hour
   b. During CH = Content to be discussed during the contact hour by the course instructor
   c. Post CH = Self Learning done post the contact hour
2. Contact Hour (CS) stands for a two-hour long live session with students conducted either in a physical classroom or enabled through technology. In this model of instruction, instructor led sessions will be for 11 CS.
   a. Pre CS = Self Learning done prior to a given contact session
   b. During CS = Content to be discussed during the contact session by the course instructor
   c. Post CS = Self Learning done post the contact session
3. RL stands for Recorded Lecture or Recorded Lesson. It is presented to the student through an online portal. A given RL unfolds as a sequences of video segments interleaved with exercises
4. SS stands for Self-Study to be done as a study of relevant sections from textbooks and reference books. It could also include study of external resources.
5. LE stands for Lab Exercises
6. HW stands for Home Work.
7. M stands for module. Module is a standalone quantum of designed content. A typical course is delivered using a string of modules. M2 means module 2.

Teaching Methodology *(Flipped Learning Model)*

The pedagogy for this course is centred around flipped learning model in which the traditional class-room instruction is replaced with recorded lectures to be watched at home as per the student's convenience and the erstwhile home-working or tutorials become the focus of classroom contact sessions. In this model, in addition to walking-through the topic-centric exercises and filling the gaps in student's comprehension, the contact sessions are also enriched with discussion on organization-specific practices and case-problems experienced by typical practising project managers in Indian IT industry.

A catalogue of such case-problems (situational leadership lessons) with continuous update based on inputs from collaborating organizations is maintained by the lead instructor. In addition, **problem-sets** are made available by the instructor as take-home exercises for student's practice.

As part of evaluation, two-week long **take-home assignments** on specific topics for study, analysis or research are assigned to individual students, at the end of which they prepare a report or make a presentation to the class.

Course Delivery

- There are 10 Contact Sessions (of 2 hours each)--5 before mid-semester and 5 post-mid-semester over a period of 20 weeks with alternate weeks for home-watching of Recorded Lectures

- The students are expected to watch the prescribed Recorded Lectures (RLs) before attending the above Contact Sessions

- The 5th & 10th Contact Sessions are planned for review of topics pre-mid-semester and pre-comprehensive examinations.

Instruction Delivery *(Recorded Lectures)*

o   Core modules are mandatory (covered under syllabus and for assessment) while Optional modules can be considered for Home-study or taken-up for discussion in Contact Sessions or given as part of assignments, however the same not to be included in the mid-sem/comprehensive evauations)

o   Minimum of one Contact Session (topics listed under CSx.y) is planned for each core module (M1…M14)

*C*ore Topics—to be covered for all / **O**ptional Topics—specific to Organization/Student Profile

as per the discretion of the instructor

#	Title of the Module	C/O*	RL Nos.	Total Min.
M1	Introduction to Software Project Management	C	RL1.1	60
M2	Overview of Software Development Models	C	RL2.1 –> 2.3	120
M3	Project Initiation & Defining Project Goals	C	RL3.1 –> 3.2	90
M4	Software Effort Estimation	C	RL4.1 –> 4.5	45

M5	Software Project Planning	C	RL5.1 – >5.4	140
M6	Software Quality Planning	C	RL6.1 –> 6.2	90
M7	Risk Management	C	RL7.1	70
M8	Change Management	C	RL8.1 –> 8.2	20
M9	Project Monitoring & Control	C	RL9.1	45
M10	Team & Stakeholder Management	C	RL10.1 –> 10.3	90
M11	Project Closure & Warranty Maintenance	C	RL11.1	40
M12	Quality Management Systems	C	RL12.1	90
M13	Contract Management	C	RL13.1	50
M14	Project Evaluation	C	RL14.1	60
M15	Proposal Making	O	-	-
M16	Cross-cultural issues in Project Management	O	RL16.1	75
M17	Tools for Software Project Management	O	-	-
M18	Software Maintenance	O	-	-
M19	Product Life-cycle Management	O	-	-
M20	Remote Infrastructure Management	O	-	-

Contact Session Plan

o Each Module (M#) covers an independent topic and module may encompass more than one Recorded Lecture (RL).

o Contact Sessions **(2hrs each week)** are scheduled alternate weeks after the student watches all Recorded Lectures (RLs) of the specified Modules (listed below) during the previous week

o In the flipped learning model, Contact Sessions are meant for in-classroom discussions on cases, tutorials/exercises or responding to student's questions/clarification--- may encompass more than one Module/RLs/CS topic.

o Contact Session topics listed in course structure (numbered CSx.y) may cover several RLs; and as per the pace of instructor/students' learning, the instructor may take up more than one CS topic during each of the below sessions

Contact Session 1

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL1.1, RL2.1, RL2.2, RL2.3	M1,M2
During CS	CS1.0, CS2.0	Introduction to SPM & Overview of Process Models	
Post-CS			
Lab Reference			

Contact Session 2

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL3.1, RL3.2	M2, M3
During CS	CS2.0, CS3.0	Project Initiation & Defining Project Goals	
Post-CS			
Lab Reference			

Contact Session 3

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL4.1 ➜ RL4.5	M4
During CS	CS4.0	Software Effort Estimation	
Post-CS			
Lab Reference			

Contact Session 4

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL5.1 ➜ RL5.4, RL6.1, RL6.2	M5, M6
During CS	CS5.0, CS6.0	Software Project Planning / Quality Planning	
Post-CS			
Lab Reference			

Contact Session 5: Review

Contact Session 6

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL7.1, RL8.1, RL8.2, RL8.3	M7, M8
During CS	CS7.0, CS8.0	Risk Management / Change Management	
Post-CS			
Lab Reference			

Contact Session 7

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL9.1, RL10.1 ➔ RL10.3	M9, M10
During CS	CS9.0, CS10.0	Project Monitoring / Team & Stakeholder Management	
Post-CS			
Lab Reference			

Contact Session 8

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL11.1, RL12.1	M11, M12
During CS	C811.0, CS12.0	Project Closure, Maintenance / Quality Systems	
Post-CS			
Lab Reference			

Contact Session 9

Time	Type	Description	Content Reference Module
Pre-CS	RL	RL13.1, RL14.1	M13, M14
During CS	CS13.0, CS14.0	Contract Management / Project Evaluation	
Post-CS			
Lab Reference			

Contact Session 10: Review
Contact Session 11: Review

Assignment Topics/Case-problems *(Situational Leadership Lessons)*

A set of ~20 case-problems/topics for study to reflect on the practices and experiences of Project Managers in student's own organizations.

#	Problem / Topic	EXPLORE/STUDY/DISCUSS (let students arrive at answers to these questions—however, not limited to these…)
1	PROJECT ESTIMATION	Is Software Project Estimation an art or science? What are the various methods employed by your Organization for estimating effort/price to be quoted to customer?
2	AGILE METHODOLOGY	When is Agile Methodology an appropriate choice for projects? Give TWO examples of your Organization's projects adopting Agile methods by explaining the process adopted.
3	METRICS	Describe the Metrics adopted in your organization in ALL the phases of SDLC. Which are the few metrics your Project Manager is most interested in? and why?
4	RISK MANAGEMENT	Why is Risk highest at the start of the project? How Project Managers minimize impact of Risk?
5	CUSTOMER COMPLAINTS	When do we receive max. number of customer complaints and why? What are the methods employed to resolve the issues to the satisfaction of the customer?
6	PROJECT SCHEDULING	Can we do Project Scheduling using AoN diagrams when Agile Methods are adopted? Draw an AON schedule diagram for one development project completed in your Organization.
7	RESOURCE MANAGEMENT	When is resource loading maximum and why? Describe the required skill-profiles of team members in a project across the phases of SDLC
8	PROGRAM MANAGEMENT	What is the key role of Program Manager? How Program Management is implemented in your organization (give examples of Programs).
9	SOFTWARE MAINTENANCE	Does Software Maintenance constitute a Project? Explain. How the productivity and performance of software maintenance engineers is tracked by customer?
10	PROJECT MONITORING	Distinguish Monitoring and Control. What are the various 'control' techniques adopted by PMs to bring troubled project back on track?
11	PROGRAMMER PRODUCTIVITY	How Project Manager can contribute to programmer productivity? What would you do if you were new to a tool/language and expected to be in the team writing the code within the next 2 weeks?
12	SOFTWARE TESTING	How is Unit-testing is different from System Testing? Distinguish Unit Testing, Integrating Testing, System Testing and Acceptance Testing with examples. How you measure productivity of Testers?
13	PROJECT STATUS REPORTING	As Project Manager, how frequently you send Project reports to your customer and what is the criteria for determining the frequency and format? Give an example of typical Project Report Format adopted in your Orgzn...
14	BUSINESS MODELS	Which Business Model mandates good project estimation skills? Why? What are the various Business Models adopted in your Orgzn. and which model you think would be least risky for the organization?
15	EARNED VALUE MGMT.	Why is EVM considered a better alternative for large projects? A project running behind-schedule need not incur cost-overrun? Do you agree? Explain with an example how EVM can ensure containment of cost-overruns?
16	CHANGE MANAGEMENT	Describe the Change Request (CR) Management process in your Organization? How do you manage changes when the Requirements are clear only at the end of the project and customer has lock-in on the budget and deadline for delivery?
17	WARRANTY MAINTENANCE	What kind of projects typically insists on warranty period? How long is the period and what is the process adopted for warranty maintenance in your Organization?
18	ANALYSIS & DESIGN	Distinguish Architecture, High-level Design and Low-Level Design with examples. In which phase of SDLC, the role of software architect is more important?
19	REQUIREMENTS CAPTURE	How do you capture requirements when the customer too is not clear of total functionality of the product? How do you manage to get requirements onsite when the customer is non-English speaking and can barely communicate to you over email or with little English?
20	CODING & UNIT-TESTING	How do you determine the number of test-cases to be written for a software module? When do you stop testing and start delivering?
21	CONTINUOUS IMPROVEMENT	What is the process for continuous improvement of processes in your Orgzn.? As an ISO 9000/CMMI compliant organization, give an example of a process improvement (related to Project Mgmt) that got implemented recently.
22	CROSS-CULTURAL ISSUES in PM	What are the challenges you face as PM while dealing with customers from non-English speaking nations (Japan, Korea…)? How do you capture requirements? How do you communicate/negotiate with customers?

Assignments

- Each student is given an individual assignment on any of the topics discussed in the class
- Assignment Topics are based on practical problems experienced or part of work-items or tools used by collaborating organization's project managers
- Assignments are take-home and deadline-driven (typically of 2 weeks duration) announced post Mid-semester examination
- Students to spend at least 16 hours of work in study, research, discussion and preparation of the report and presentation.
- As part of deliverables, the student is expected to prepare a report and make a short-presentation in the class

Evaluation Scheme

No	Name	Type	Duration	Weight	Day, Date, Session, Time
EC-1	Quiz-1		*	5%	August 16-30, 2021
	Quiz-2		*	5%	September 16-30, 2021
	Assignment		*	10%	October 16-30, 2021
EC-2	Mid-Semester Test	Open Book	2 hours	30%	Saturday, 25/09/2021 (FN) 10 AM - 12 Noon
EC-3	Comprehensive Exam	Open Book	2 hours	50%	Saturday, 13/11/2021 (FN) 10 AM - 12 Noon

__Note__ - Evaluation components can be tailored depending on the proposed model.

__Important Information:__

Syllabus for Mid-Semester Test (Open Book): Topics in CS 1-5.
Syllabus for Comprehensive Exam (Open Book): All topics given in plan of study
Evaluation Guidelines:

1. For Closed Book tests: No books or reference material of any kind will be permitted. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.

2. For Open Book exams: Use of prescribed and reference text books, in original (not photocopies) is permitted. Class notes/slides as reference material in filed or bound form is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.

3. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam. The genuineness of the reason for absence in the Regular Exam shall be assessed prior to giving permission to appear for the Make-up Exam. Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the lectures, and take all the prescribed evaluation components such as Assignment/Quiz, Mid-Semester Test and Comprehensive Exam according to the evaluation scheme provided in the handout.

Appendix

Course Plan

Contact Session	Topics	Ref Modules	Pre-contact Session prep	During Contact Session	CP# for Discussion
1	Introduction to SPM & Overview of Process Models	M1,M2	RL1.1, RL2.1, RL2.2, RL2.3	CS1.0, CS2.0	2,18,19,20
2	Project Initiation & Defining Project Goals	M2, M3	RL3.1, RL3.2	CS2.0, CS3.0	
3	Software Effort Estimation	M4	RL4.1 ➜ RL4.5	CS4.0	1
4	Software Project Planning / Quality Planning	M5, M6	RL5.1 ➜ RL5.4, RL6.1, RL6.2	CS5.0, CS6.0	16,17
5	**(All topics covered till date)**	**M1 ➜ M6**	**(All RLs in M1➜M6)**	**Pre-Mid Review**	
6	Risk Management / Change Management	M7, M8	RL7.1, RL8.1, RL8.2, RL8.3	CS7.0, CS8.0	
7	Project Monitoring / Team & Stakeholder Management	M9, M10	RL9.1, RL10.1 ➜ RL10.3	CS9.0, CS10.0	3,5,15,11
8	Project Closure, Maintenance / Quality Systems	M11, M12	RL11.1, RL12.1	C811.0, CS12.0	21
9	Contract Management / Project Evaluation	M13, M14	RL13.1, RL14.1	CS13.0, CS14.0	
10	**(All Core topics in syllabus / covered till date)**	**M1 ➜ M14**	**(All RLs in M1 ➜ M14)**	**Pre-Compre Review**	
11	**Review**				

CP: attached list of topics for experiential learning; can be given as assignments to students or taken up for discussion in contact sessions