Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, July 2020

Programme Name: B.Tech Mechanical **Semester : VI**
Course Name : Work study & Ergonomics **Time : 03 hrs**
Course Code : MEPD3008 **Max. Marks : 100**
Nos. of page(s) : 8
Instructions: All questions are compulsory.

SECTION A

S. No.		Marks	CO
Q 1	Work study is concerned with (a) improving present method and finding standard time (b) motivation of workers (c) improving production capability (d) improving production planning and control (e) all of the above.	**1**	**CO1**
Q 2	Basic tool in work study is (a) graph paper (b) process chart (c) planning chart (d) stop watch (e) analytical mind.	**1**	**CO1**
Q 3	What does symbol 'O' imply in work study (a) operation (b) inspection (c) transport (d) delay/temporary storage (e) none of the above.	**1**	**CO1**
Q 4	What does symbol 'D' imply in work study (a) inspection (b) transport (c) delay/temporary storage (d) permanent storage (e) none of the above.	**1**	**CO1**
Q 5	Work study is most useful (a) where production activities are involved (b) in judging the rating of machines	**1**	**CO1**

	(c) in improving industrial relations (d) in judging the output of a man and improving it (e) where men are biggest contributor to success of a project.		
Q 6	Micro motion study is (a) enlarged view of motion study (b) analysis of one stage of motion study (c) minute and detailed motion study (d) subdivision of an operation into therbligs and their analysis (e) motion study of small components upto mirco-seconds.		**CO2**
Q 7	In micro motion study, therbligs is described by (a) a symbol (b) an event (c) an activity (d) micro motions (e) standard symbol and color.		**CO2**
Q 8	The allowed time for a job equals standard time plus (a) policy allowance (b) interference allowance (c) process allowance (d) learning allowance (e) unforeseen allowance.		**CO2**
Q 9	The standard time for a job is (a) total work content (b) base time + relaxation time (c) total work content + basic time (d) total work content + delay contingency allowance (e) total work content + relaxation time.		**CO2**
Q 10	Micro motion study is (a) analysis of a man-work method by using a motion picture camera with a timing device in the field of view (b) motion study observed on enhanced time intervals (c) motion study of a sequence of operations conducted systematically (d) study of man and machine conducted simultaneously (e) scientific, analytically procedure for determining optimum work method.		**CO2**
Q 11	Time study is (a) the appraisal, in terms of time, of the value of work involving human effort (b) machine setting time (c) time taken by workers to do a job		**CO2**

	(d) method of fixing time for workers (e) method of determining the personnel Requirement.		
Q 12	**The following factor(s) must be considered while selecting the work for method study** (a) Economic considerations (b) Technical considerations (c) Human reactions (d) All of the above		**CO1**
Q 13	**Delay occurs when** (a) someone stops the process (b) product wait for next event (operation) (c) both 'a' and 'b' (d) None of the above		**CO1**
Q 14	**A milk powder tin is being weighed as it is filled is an example of** (a) Operation cum transportation (b) Operation cum inspection (c) Transportation cum inspection (d) None of the above		**CO1**
Q 15	If a worker working at 110 % rating complete his job in 10 min, then the basic allowed time is (a) 8 min (b) 10 min (c) 11 min (d) 12 min		**CO2**
Q 16	An 8 hour work measurement study in a plant reveals that; number of units produced = 408, ideal time = 15 %, performance rating = 120 %, allowance = 12 % of normal time, determine standard time/unit produced. (a) 1.2 min (b) 2.1 min (c) 1.34 min (d) 3.2 min		**CO2**
Q 17	Which of the following is not a form of financial incentives (a) Bonus (b) Profit sharing (c) Both bonus and profit sharing (d) Job security		**CO3**
Q 18	Operator's performance may depends upon the estimate of (a) Standard output (b) Job security (c) Job satisfaction (d) Product quality		**CO3**
Q 19	An Incentive scheme should provide (a) Improvements in utilization of tools and plant (b) Recognition to a worker for good contribution (c) Improve relations between workers and management (d) All of the above		**CO3**
Q 20	The Earning of Worker can be calculated as		**CO3**

	(a) Earning of a worker = No. of pieces produced x rate per piece (b) Earning of worker =No. of workers x rate per piece (c) Earning of worker = No. of pieces produced x production rate (d) All of these		
Q 21	Ergonomics is the science of defining work limits to (a) Work measurement (b) Work capability (c) Human Capability (d) Human postures		**CO4**
Q 22	Consider an output standard of 20 pieces per day with a wage rate of Rs 40 Per hour under 8 hour a day, calculate guaranteed wage rate. (a) 320 (b) 360 (c) 380 (d) 300		**CO3**
Q 23	Emerson's efficiency plan, the efficiency of a worker is calculated as (a) Output time x 100/actual time taken by worker to complete job (b) Standard time x 100/actual time taken by worker to complete job (c) Standard time x 50/Actual time taken by worker to complete job (d) None of these		**CO3**
Q 24	According to the rules concerning to human body, there should be (a) Definite fixed and accessible place of tools (b) Both the hands should be engaged in the productive work (c) Gravity should be preferred to deliver the assembled parts (d) Multi purse tools should be used		**CO4**
Q 25	Micro motion analysis is done by using a combination of 17 basic motions which are known as (a) Micro motions (b) Therbligs (c) Macro motions (d) None of the above		**CO2**
	SECTION B		
Q 1	In a stop watch time study, the elemental time observed in sec is; 30,29,30,29,30,30,31,30,30 and 31. Examine whether the number of observations are enough at $\pm$5 % accuracy with 95 % confidence level.	**5**	**CO2**
Q 2	In a small scale unit, the minimum guaranteed wage is fixed at Rs 160 per day. The standard piece rate is .80 per piece. Two worker A & B are producing 230 and 179 pieces per day respectively, what would be their daily wages?	**5**	**CO3**
Q 3	What is antropometry? Define minimum and maximum dimension with 5 different examples.	**5**	**CO4**
Q 4	A 5 mm dia hole is drilled in a 25 mm dia steel shaft at a distance of 30 mm from its one end. Total length of the shaft is 200 mm. For time study purpose, the analyst has divided	**10**	**CO2**

The elemental time data for 8 cycles and the rating of each element and determined by the analyst are given below:

Element	Activity	Element Times (Sec.)								Rating factor
		Cycles								
		1	2	3	4	5	6	7	8	
1	Pick up shaft and place in jig	.14	.13	.12	.11	.12	.13	.13	.12	80%
2	Tighten Bolt	.11	.10	.12	.10	.09	.11	.11	.11	95%
3	Bring drill to workpiece	.04	.05	.05	.06	.04	.05	.04	.05	120%
4	drill hole (Hand Free)	.81	.86	.80	.90	.88	.85	.84	.86	90%
5	Raise drill from hole	.05	.05	.04	.06	.05	.05	.04	.06	110%
6	Loosen Bolt	.10	.09	.11	.09	.10	.09	.10	.10	100%
7	Remove shaft from jig	.07	.08	.08	.07	.08	.07	.08	.08	100%
8	Blow out chips from jig	.15	.15	.16	.15	.14	.14	.15	.15	80%

(a) Prepare the time study observation sheet for this operation showing the watch reading if continuous method of reading the stop watch was used. (10)

(b) Also determine the normal time of this operation. (10)

Q 5

A stop watch time study has been made of an operation which consist of four elements. The table below gives the continuous time readings (in centiminutes), ratings and allowances for the elements. Determine

i. Basic time and standard time for each element.
ii. Standard of operation.
iii. Whether the number of operations are sufficient for each element if the desired confidence level is 90% and accuracy required is ± 5%.

Element	1	2	3	4
Observation	Continuous stop watch readings (Centimin.)			
1	9	15	28	32
2	40	46	59	62
3	71	80	94	97
4	106	113	127	130
5	138	143	156	159
6	167	172	184	188
7	198	203	218	221
8	228	233	246	249
9	257	262	275	279
10	288	293	306	309

10 **CO1**

	Avg. Rating (%)	105	110	100	90			
	Allowance (%)	15	10	20	25			
Q 6	A researcher is engaged in collecting physiological data of 3 subjects (A,B,C) in Ergonomics laboratory. The data w.r.t. setting time, recording time and unloading time is given in the table below. Make a multiple activity chart so that all the four workers are checked on each machine. Calculate the idle time for the researcher and 3 machines and waiting time for each subject.						**10**	**CO2**

Name of test on machine	HRV	BERA	BP
Setting time (min)	5	7	2
M/C Running Time (Min)	15+5=20	3+3=6	2
Un loading time (Min)	3	3	1

Q 7	A work study engineer conducted stopwatch time study on a job for taking the observations the job was divided into 5 elements. The observations made on 4 cycles (in minutes) of all the 5 elements are shown in the table given below. Calculate the normal time and standard time for the job. If relaxation allowances of 12 %, contingency allowance if 3% and incentive of 20 % are applicable for the job.	10	**CO2**

Element	*Time (minutes) for Cycle*				*Performance Ratting*
	1	*2*	*3*	*4*	
1	1.246	1.328	1.298	1.306	90
2	0.972	0.895	0.798	0.919	100
3	0.914	1.875	1.964	1.972	100
4	2.121	2.198	2.146	2.421	110
5	1.253	1.175	1.413	2.218	100

Q8	Prepare a material type process flow chart for the following activity?	10	**CO1**

DISTANCE (m)	ACTIVITY	TYPE OF ACTIVITY
	In old-engine stores	
	Picked up engine by crane (electric)	*Non-productive*
24	*Transported to next crane*	,,
	Unloaded to floor	,,
	Picked up by second crane (electric)	,,
30	*Transported to stripping bay*	,,
	Unloaded to floor	,,
	Engine stripped	*Productive*
	Main components cleaned and laid out	,,
	Components inspected for wear; inspection report written	*Non-productive*
3	*Parts carried to degreasing basket*	,,
	Loaded for degreasing by hand-operated crane	,,
1.5	*Transported to degreaser*	,,
	Unloaded into degreaser	,,
	Degreased	*Productive*
	Lifted out of degreaser by crane	*Non-productive*
6	*Transported away from degreaser*	,,
	Unloaded to ground	,,
	To cool	,,
12	*Transported to cleaning benches*	,,
	All parts completely cleaned	*Productive*
9	*All cleaned parts placed in one box*	*Non-productive*
	Awaiting transport	,,
	All parts except cylinder block and heads loaded on trolley	,,
76	*Transported to engine inspection section*	,,
	Parts unloaded and arranged on inspection table	,,
	Cylinder block and head loaded on trolley	,,
76	*Transported to engine inspection section*	,,
	Unloaded on ground	,,
237.5	*Stored temporarily awaiting inspection*	,,

<table>
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<td>Q 9</td>
<td>A metal component is required to be produced in a large number (approximately 1000/day). Two successive milling operations are required which are done on milling machines with automatic feed. The operator need not attend to the machine during the machining operation of the cycle. The operating characteristic of the two operations are as given below;
<table>
<tr><td></td><td>Operation1</td><td>Operation2</td></tr>
<tr><td>Unload</td><td>.12 minute</td><td>.11 minute</td></tr>
<tr><td>Load</td><td>.19 minute</td><td>.15 minute</td></tr>
<tr><td>mill</td><td>.38 minute</td><td>.45 minute</td></tr>
</table>
On the average these machines are working approximately 75 % of the 8 Hr working a day. What arrangement of men and machines would you recommend? Support your answer with suitable multiple activity chart. You may assume any convenient arrangement of machines.</td>
<td>10</td>
<td>CO1</td>
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