GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Diploma

Branch: Printing Technology

Course / Subject Code : DI03058031

Course / Subject Name : Offset Printing Process

w. e. f. Academic Year:	2024-25
Semester:	3rd
Category of the Course:	PCC

Prerequisite:	**Basic knowledge of different printing process and graphic design**
Rationale:	In Printing Industry, Offset Printing is still the leading technology for porous. To acquire knowledge of this course student must have information about offset principle and image carrier generation. This course will impart an extensive knowledge of all the elements of printing operation and functions of the offset process. Machine configurations, machine units of sheet fed machine, registration methods, ancillary operations and troubleshooting problems etc. are the main elements of this course which will enable the student to handle all the necessary operations and equipment related to the offset printing machines. It gives information about print production work flow during inline operations.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Choose sheet fed offset machine configuration for given job	R, U, A
02	Set feeder unit of offset machine according to substrate	R, U, A
03	Set dampening unit of offset machine according to job	R, U, A
04	Set inking unit of offset machine according to job	R, U, A
05	Operate Printing and Delivery mechanism for required output	R, U, A
06	Troubleshoot different issues arising during printing	R, U, A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA(M)	PA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
Unit – I Sheet fed offset machine	1.1 Lithographic offset – working principle, Invention and history of offset machine. 1.2 Development of offset machine 1.3 Construction of sheet fed offset press 1.4 Categories of sheet fed press 1.5 Advantages and limitations of offset machine 1.6 Applications of offset machine, 1.7 Comparison with other printing processes, 1.8 Configurations of sheetfed machines: single color, multi color, perfecting press, satellite press, CIC	04	12
Unit– II Feeding unit	2.1 Function of feeder 2.2 Feeder cycle 2.3 Feeder types – manual feeder, automatic feeder, single sheet feeder and stream feeder, continuous feeder, friction feeder, pneumatic feeder 2.4 Working components of feeding unit – pile height governor, Pile board, feed board (Ram board), sheet separation, sheet lifting, sheet forwarding, conveying board, sheet control mechanism on feed board, sheet register, two sheet detector, no sheet detector, front / back separation, sheet insertion and transfer, side lay and types, front lay, gripper	08	22
Unit - III Dampening unit	3.1 Characteristics of dampening system 3.2 Image and non image area of plate 3.3 Retention of plate relative selectivity 3.4 Fountain solution: water, acid, wetting agents or surfactants, plate conditioners, gum Arabic, 3.5 Parameter for fountain solution: pH, conductivity, hardness of water, Role of alcohol, factor affecting the amount of fountain solution 3.6 Construction and working of dampening system, Rollers in dampening system: form roller, pan roller, doctor roller, vibrator roller, 3.7 Covering of dampening roller: stockiniette cloth, molleton cloth, paper covering, synthetic covering, 3.8 Setting of roller, desensitizing the metal roller 3.9 Types of dampening system – Conventional, direct and	06	12

	indirect dampening system, continuous dampening system, the dampen orr system, brush system, flapper system, air mist system, dahlgren system, micro flow system, alcohol system, inker feed. Care and maintenance of dampening system		
Unit– IV Inking unit	4.1 Role and functions of inking system, theory of ink flow and factors affecting it, ink-water balance, 4.2 Parts of inking system: fountain section – fountain blade, ink keys, ink agitator, split duct, fountain roller, doctor roller, distribution section – vibrator, distributors, riders, from roller section – form roller, hickie pickers, form roller setting 4.3 Inking system – central drum system, multiroll inking system, underneath inking system, drum inking system 4.4 Different inking rollers: synthetic rubber rollers, polyurethane rollers, davis process rollers, natural rubber rollers, vulcanized oil rollers, PVC rollers, 4.5 Care and maintenance of inking system, shore hardness, working and types, required properties and storage conditions, ink film thickness	07	12
Unit– V Printing unit	5.1 Plate cylinder: bolting clamp, cam clamp, detachable clamp, cylinder gears, cylinder gears, cylinder gap 5.2 Blanket cylinder: bearers, bearer pressure, undercut 5.3 Blanket types, construction of blanket, characteristics of blanket, features of blanket, blanket selection, packing, storage and handling, 5.4 Impression cylinder: cylinder packing, patching, image enlargement, image reduction, printing pressure, cylinder setting theory, cylinder balancing, bearer to bearer adjustment 5.5 Transfer cylinder, sheet transfer, sheet delivery, short and extended carriers, sheet control devices, anti set off spray powder	08	20
Unit– VI Troubleshooting	6.1 Catching up, color too weak, dot gain, fading, grey and weak solids muddy half tones, plate blinding, plate wear, scumming, double image, trapping 6.2 Embossing, misregister, mottle, piling, plate wear, slurring, double image, 6.3 Dot gain, distribution, ink water balance, misting,	08	16

	misregister, mottle, muddy halftones, picking or linting, piling, plate wear, roller stripping, slurring, double image, tinting or toning, 6.4 Catching up, chalking, color too weak, color variation, dot gain, drying, gloss, grey and week solids, ink water balance, mottle, muddy halftones, picking or linting, plate blinding, roller stripping, rub off or scuffing, scumming, tinting, toning, 6.5 Chalking, color variation, drying, ghosting, gloss, hickies, mileage, misregister, mottle, picking or linting, piling, rub off or scuffing, double image, tinting or toning, 6.6 Backing, blocking, catching up, chalking, color too weak, color variation, crystallization, dot gain, distribution, drying, embossing, fading, ghosting, gloss, grey and weak solids, hickies, ink water balance, mileage, misting, misregister, mottle, muddy half tones, picking or linting, piling, plate blinding, roller stripping, rub off or scuffing, scumming, set off or blocking, tinting or tonning, trapping		
Unit – VII Sustainable development in offset printing	7.1 Different sustainable development in offset industry like reduced power consumption, newly developed drying system, less wastage, short make ready time, less man power, increase productivity, 7.2 Ink wash up system and its disposal 7.3 Green fountain solution and ink 7.4 Renewable resources in printing press	04	06
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
28	48	24	NA	NA	NA

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Litho Offset Press Operating - Charles W Latham - Graphic Arts Technical Foundation; Revised edition (1967) ASIN -B0007FKTSQ
2. Sheetfed Offset Press Operating - Lloyd P. Dejidas, Thomas M. - Graphic Arts Technical Fndtn; 2nd edition (June 1, 1995), ISBN-13: 978-0883621714
3. Solving Sheetfed Offset Press Problems - Gatf (Author) - Graphic Arts Technical Fndtn; 3 Edition (1994), ISBN-13: 978-0883621677
4. Handbook of Print Media - Prof. Dr.-Ing. habil. Helmut Kipphan - Springer-Verlag Berlin Heidelberg New York,ISBN3-540-67326-1
5. Print and Production Manual - Michael Barnard - Pira International, United Kingdom - ISBN 1 85802 238 X

(b) Open source software and website:

1. https://www.youtube.com/watch?v=RW1HJdW5XLs : introduction to sheet fed machine
2. https://www.youtube.com/watch?v=pNZb7CXUjs0 : working of offset machine
3. https://www.youtube.com/watch?v=uzHhrXFv9_o : operating of sheet fed machine
4. https://www.youtube.com/watch?v=ILuYMI2Xer0 : roller setting
5. https://www.youtube.com/watch?v=9T2q7eDXwJs : printing operation and density checking
6. https://www.youtube.com/watch?v=DGW5Ya9Z2AE: perfecting operation
7. https://www.youtube.com/watch?v=mB7t1mUndFQ: feeding section
8. https://www.youtube.com/watch?v=GMVmQe2EVkM : plate mounting
9. https://www.youtube.com/watch?v=R09fp9kB71A: machine installation
10. https://www.youtube.com/watch?v=lbzK-kB0HTQ: delivery setting

Suggested Course Practical List:

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Print single color job using litho stone	I	02
2	Identify and elaborate working of different parts of sheet fed machine	I	02
3	Identify and elaborate working of different configuration of offset sheet fed machine	I	02
4	Draw workflow of for perfecting sequence of printing operation for given job	I	02
5	Perform feeding unit settings for printing on paper on sheet fed machine	II	02
6	Perform feeding unit settings for printing on board on sheet fed machine	II	02
7	Check pH, conductivity and TDS of dampening solution.	III	02
8	Check dampening roller setting of offset machine	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
9	Prepare fresh dampening solution batch with given fountain solution	III	02
10	Perform Inking unit settings according to construction of units on sheet fed machine	IV	02
11	Check ink roller setting of offset machine	IV	02
12	Cleaning of inking and Dampening unit	IV	02
13	Perform plate mounting operation on sheet fed machine	V	02
14	Perform blanket changeover operation on sheet fed machine	V	02
15	Perform side lay and front lay settings according to construction of units on sheet fed machine	V	
16	Perform delivery unit setting of sheet fed offset machine	V	02
17	Demonstrate functions of transfer drum used for both side printing in single pass on sheet fed machine	V	02
18	Perform roller cleaning, blanket cleaning and plate cleaning operation with press consumable chemicals	V	02
19	Print single color job on map litho paper with sheet fed machine	V	02
20	Print two color job on map litho paper with sheet fed machine	V	02
21	Print four color job on art paper with sheet fed machine	V	02
22	Demonstrate functions of metal decoration press used for printing on metal sheet on sheet fed machine	V	02
23	Perform sheet fed machine calibration	VI	02
24	Perform maintenance schedule for sheet fed machine	VI	02
25	Perform inspection schedule of sheet fed machine	VI	02
26	Resolve problems occur during printing on sheet fed machine	VI	02
27	Measure opacity and density of given printing ink samples.	VI	02
28	Perform draw down test on CMYK inks	VI	02
	Minimum 14 Practical Exercises		**28 Hrs.**

Major equipment/ Instruments required

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	**Single color offset machine** Maximum Paper Size : 380 x 508 mm Minimum Paper Size : 125 x 175 mm Maximum Printing Area : 357 x 485 mm Paper Thickness : 30 to 300 gsm Blanket : 4 ply rubber blanket, 1.9 mm thick gripper margin on Paper : 8 to 10 mm gripper margin on Plate : 32 mm (1.25”) Gripper Bite : 4 mm	2 to 28

S. No.	Equipment Name with Broad Specifications	PrO. No.
	plate thickness : 0.05 to 0.2 mm direct offset master thickness : 100 micron Inking unit : 9 rollers including 2 oscillators, 2 form rollers Dampening unit : 4 rollers including 1 oscillator, 1 form roller Main drive motor : 1 Hp 230 V AC three phase (connectable to single phase power supply) Compressor pump motor : 1 Hp 230 V AC single phase Speed : 1500 to 5000 iph Physical Dimensions (L x W x H) : 1420 x 1165 x 1300 mm Gross Weight : 1250 Kg approx. (packed)	
2	Four color offset machine Maximum paper size : 460x640mm Minimum paper size : 240x280mm Maximum Printing Area : 445x636mm Paper thickness : 40 GSM to 400 GSM Blanket : 4 ply rubber blanket, 570x645 1.7mm mm thick gripper Margin on paper : 5 to 8 mm Gripper margin on plate : 32 mm (1.25”) Gripper bite : 9 mm Plate size: 510x645 Plate thickness : 0.30 mm Inking unit : 20 rollers including 3 form rollers Dampening unit : 5 rollers including Main drive motor : 3 phase D.C. 415 V, 50 Hz Speed : 2000 to 10000 IPH Physical dimensions (L x W x H) : 2900x2030/4600x2160mm1650mm Gross Weight : 6500 Kg approx. (packed)	1 to 28
3	**Litho stone**	1
4	**Pressroom tools – plate punch, blanket clamp, tool box**	
5	Ink proofing kit Tape width: 20-40 mm Usage: drawdown Model: manual Printing width : 50 mm Printing length: 110 mm Roll diameter: 35 mm Roll length : 50 mm	12 to 28

S. No.	Equipment Name with Broad Specifications	PrO. No.
6	Printer Laser jet black and white, print resolution: 600 x 600 DPI, print speed: 24 PPM, print size: A3, A4	15,16,17
7	Fuser Size: A3 Model: semi-automatic Material: metal Weight: 110 Kg	15,16,17
8	Vernier Caliper Range: 0-100 mm Depth Bar: 1.9 mm Max. permissible error E MPE: ±0.05 mm Max. permissible error S MPE:±0.07 mm Mass: app. 128g With upper locking screw: Yes	09,13,14
9	Micrometer Screw Gauge Range: 0-1 Inch Accuracy: ±0.0001 Inch Mass: app. 175g	09,13,14
10	Durometer – Rubber Hardness Series A Type: handheld dial durometer Range: 10 to 90 Dial reading: 10-90 Indenter shape: blunt taper Depth: 1.3 in Height: 7.4 in Width: 2.3 in Tip Angle: 35 degrees ASTM D 2240, DIN 53 505, ISO 7619, ISO868, JIS K 6253, JIS K 7215	09,13,14

Suggested Project List: -

1. Collect the information of various Offset machines setup installed in Local area/ City
2. Enlist various software used for job imposition and give details of workflow of software.
3. Collect product samples from different stages of procedure of printed product

4. Enlist all the equipment used on Production floor along with photograph and parallel terminology used by local workers.
5. Collect information about quality standard followed in local press setups and prepare report.
6. Collect information about latest software and machines used for offset production job handling
7. Enlist raw material used in printing press along with costing and procurement process.
8. Collect production workflow samples of publication job produced in local area bindery
9. Prepare a report on rollers used in offset printing process with its material
10. Collect samples of different consumables used in sheet fed offset machine and prepare report on it
11. Collect information of different blanket manufacturer with their products and prepare report on it
12. Collect information of inks manufacturer unit and their product for offset printing also prepare report
13. Collect brochure of different offset machine manufacturer and compare their specification.
14. Collect information on different parts supplier of offset machine and check availability and rate of different parts
15. Collect data of five different offset machine and compare their features
16. Collect information machine applicable to packing industry and prepare report
17. Collect information on machine applicable to commercial jobs and prepare report
18. Collect the information on green printing and write a report
19. Collect information regarding environment friendly inks and prepare report
20. Collect information regarding waste disposal generated by offset printing process.

Suggested Activities for Students:

Students should perform following activities in group and prepare reports of about 5 pages for each activity. They should also collect/record physical evidences for their (student's) portfolio which may be useful for their placement interviews:

1. Prepare journals based on practical performed in laboratory
2. Give seminar on relevant topic
3. Undertake micro projects
4. Market survey for innovative ideas
5. Collect specimen of different substrates and inks
6. Prepare catalogue for different specimen printed by offset process
7. Collect defected specimen and show various defect and find our causes for it
8. Visit press setups in local area to learn workflow of commercial job production
9. Visit press setups in local area to learn workflow of news paper production
10. Visit press setups in local area to learn workflow of publication job production

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